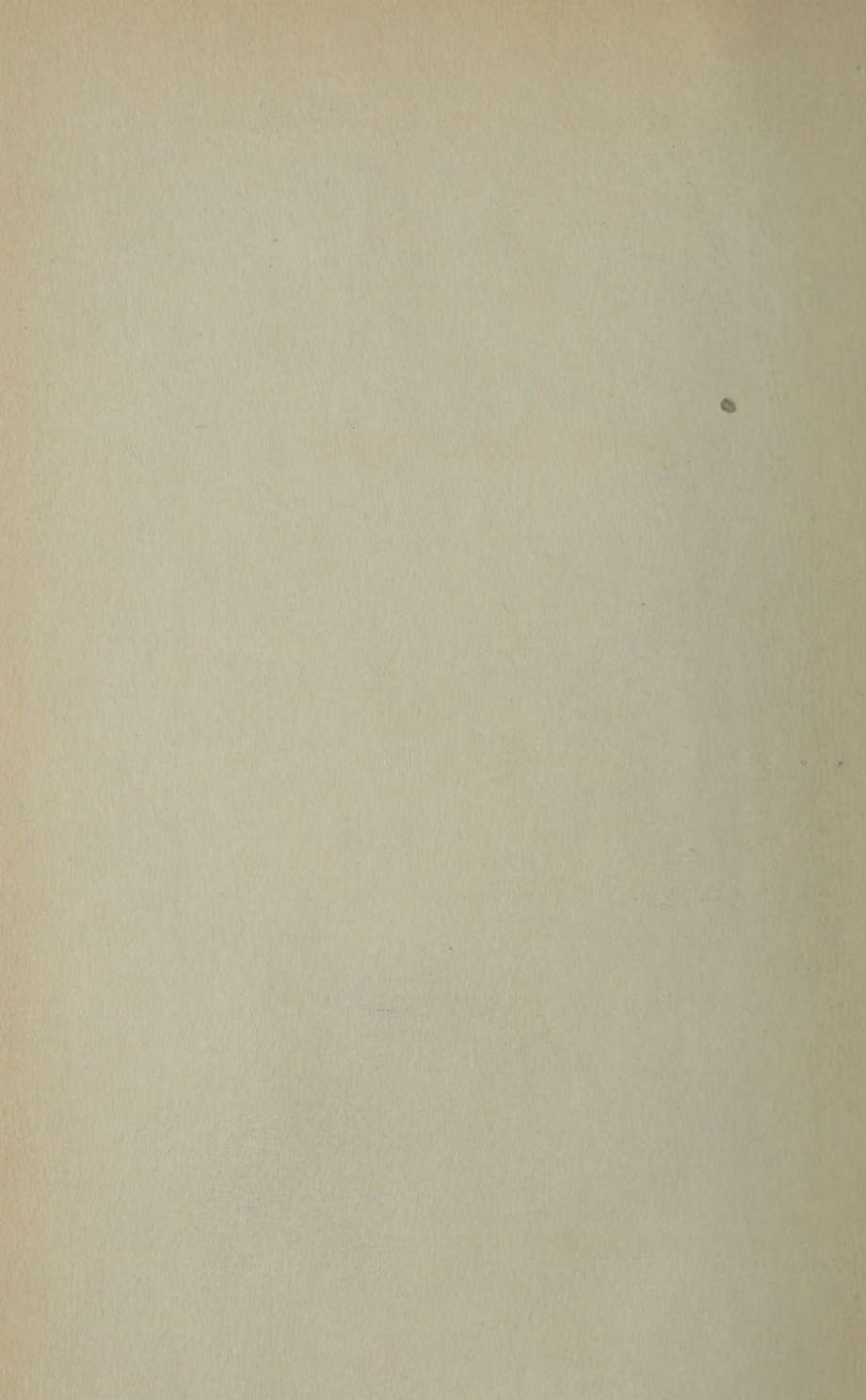


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WAYS OF NATURE
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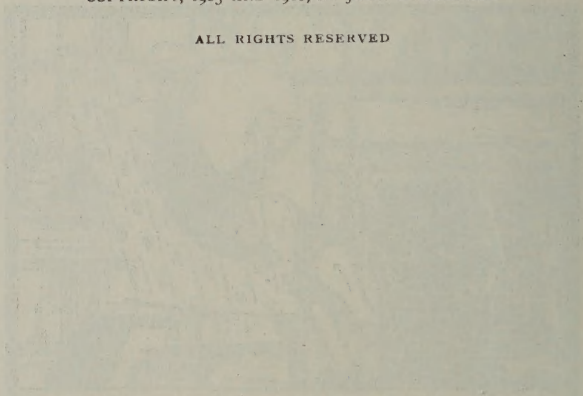
John Burroughs



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WAYS OF NATURE

PREFACE

MY reader will find this volume quite a departure in certain ways from the tone and spirit of my previous books, especially in regard to the subject of animal intelligence. Heretofore I have made the most of every gleam of intelligence of bird or four-footed beast that came under my observation, often, I fancy, making too much of it, and giving the wild creatures credit for more "sense" than they really possessed. The nature lover is always tempted to do this very thing; his tendency is to humanize the wild life about him, and to read his own traits and moods into whatever he looks upon. I have never consciously done this myself, at least to the extent of willfully misleading my reader. But some of our later nature writers have been guilty of this fault, and have so grossly exaggerated and misrepresented the every-day wild life of our fields and woods that their example has caused a strong reaction to take place in my own mind, and has led me to set about examining the whole subject of animal life and instinct in a way I have never done before.

In March, 1903, I contributed to "The Atlantic Monthly" a paper called "Real and Sham Natural History," which was as vigorous a protest as I could

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make against the growing tendency to humanize the lower animals. The paper was widely read and discussed, and bore fruit in many ways, much of it good and wholesome fruit, but a little of it bitter and acrid. For obvious reasons that paper is not included in this collection. But I have given all the essays that were the outcome of the currents of thought and inquiry that it set going in my mind, and I have given them nearly in the order in which they were written, so that the reader may see the growth of my own mind and opinions in relation to the subject. I confess I have not been fully able to persuade myself that the lower animals ever show anything more than a faint gleam of what we call thought and reflection, — the power to evolve ideas from sense impressions, — except feebly in the case of the dog and the apes, and possibly the elephant. Nearly all the animal behavior that the credulous public looks upon as the outcome of reason is simply the result of the adaptiveness and plasticity of instinct. The animal has impulses and impressions where we have ideas and concepts. Of our faculties I concede to them perception, sense memory, and association of memories, and little else. Without these it would be impossible for their lives to go on.

I am aware that there is much repetition in this volume, and that the names of several of the separate chapters differ much more than do the subjects discussed in them.

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When I was a boy on the farm, we used to thrash our grain with the hand-flail. Our custom was to thrash a flooring of sheaves on one side, then turn the sheaves over and thrash them on the other, then unbind them and thrash the loosened straw again, and then finish by turning the whole over and thrashing it once more. I suspect my reader will feel that I have followed the same method in many of these papers. I have thrashed the same straw several times, but I have turned it each time, and I trust have been rewarded by a few additional grains of truth.

Let me hope that the result of the discussion or thrashing will not be to make the reader love the animals less, but rather to love the truth more.

June, 1905.

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I

WAYS OF NATURE

I WAS much amused lately by a half-dozen or more letters that came to me from some Californian schoolchildren, who wrote to ask if I would please tell them whether or not birds have sense. One little girl said: "I would be pleased if you would write and tell me if birds have sense. I wanted to see if I could n't be the first one to know." I felt obliged to reply to the children that we ourselves do not have sense enough to know just how much sense the birds and other wild creatures do have, and that they do appear to have some, though their actions are probably the result of what we call instinct, or natural prompting, like that of the bean-stalk when it climbs the pole. Yet a bean-stalk will sometimes show a kind of perversity or depravity that looks like the result of deliberate choice. Each season, among my dozen or more hills of pole-beans, there are usually two or three low-minded plants that will not climb the poles, but go groveling upon the ground, wandering off among the potato-vines or cucumbers, departing utterly from the traditions of their race, becoming shiftless and vagrant. When

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I lift them up and wind them around the poles and tie them with a wisp of grass, they rarely stay. In some way they seem to get a wrong start in life, or else are degenerates from the first. I have never known anything like this among the wild creatures, though it happens often enough among our own kind. The trouble with the bean is doubtless this: the Lima bean is of South American origin, and in the Southern Hemisphere, beans, it seems, go the other way around the pole; that is, from right to left. When transferred north of the equator, it takes them some time to learn the new way, or from left to right, and a few of them are always backsliding, or departing from the new way and vaguely seeking the old; and not finding this, they become vagabonds.

How much or how little sense or judgment our wild neighbors have is hard to determine. The crows and other birds that carry shell-fish high in the air and then let them drop upon the rocks to break the shell show something very much like reason, or a knowledge of the relation of cause and effect, though it is probably an unthinking habit formed in their ancestors under the pressure of hunger. Froude tells of some species of bird that he saw in South Africa flying amid the swarm of migrating locusts and clipping off the wings of the insects so that they would drop to the earth, where the birds could devour them at their leisure. Our

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squirrels will cut off the chestnut burs before they have opened, allowing them to fall to the ground, where, as they seem to know, the burs soon dry open. Feed a caged coon soiled food, — a piece of bread or meat rolled on the ground, — and before he eats it he will put it in his dish of water and wash it off. The author of "Wild Life Near Home" says that muskrats "will wash what they eat, whether washing is needed or not." If the coon washes his food only when it needs washing, and not in every individual instance, then the proceeding looks like an act of judgment; the same with the muskrat. But if they always wash their food, whether soiled or not, the act looks more like instinct or an inherited habit, the origin of which is obscure.

Birds and animals probably think without knowing that they think; that is, they have not self-consciousness. Only man seems to be endowed with this faculty; he alone develops disinterested intelligence, — intelligence that is not primarily concerned with his own safety and well-being, but that looks abroad upon things. The wit of the lower animals seems all to have been developed by the struggle for existence, and it rarely gets beyond the prudential stage. The sharper the struggle, the sharper the wit. Our porcupine, for instance, is probably the most stupid of animals and has the least speed; it has little use for either wit or celerity of movement. It carries a death-dealing

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armor to protect it from its enemies, and it can climb the nearest hemlock tree and live on the bark all winter. The skunk, too, pays for its terrible weapon by dull wits. But think of the wit of the much-hunted fox, the much-hunted otter, the much-sought beaver! Even the grouse, when often fired at, learns, when it is started in the open, to fly with a corkscrew motion to avoid the shot.

Fear, love, and hunger were the agents that developed the wits of the lower animals, as they were, of course, the prime factors in developing the intelligence of man. But man has gone on, while the animals have stopped at these fundamental wants, — the need of safety, of offspring, of food.

Probably in a state of wild nature birds never make mistakes, but where they come in contact with our civilization and are confronted by new conditions, they very naturally make mistakes. For instance, their cunning in nest-building sometimes deserts them. The art of the bird is to conceal its nest both as to position and as to material, but now and then it is betrayed into weaving into its structure showy and bizarre bits of this or that, which give its secret away, and which seem to violate all the traditions of its kind. I have the picture of a robin's nest before me, upon the outside of which are stuck a muslin flower, a leaf from a small calendar, and a photograph of a local celebrity. A more incongruous use of material in bird architecture it would be

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hard to find. I have been told of another robin's nest upon the outside of which the bird had fastened a wooden label from a near-by flower-bed, marked "Wake Robin." Still another nest I have seen built upon a large, showy foundation of the paper-like flowers of *antennaria*, or everlasting. The wood thrush frequently weaves a fragment of newspaper or a white rag into the foundation of its nest. "Evil communications corrupt good manners." The newspaper and the rag-bag unsettle the wits of the birds. The phœbe-bird is capable of this kind of mistake or indiscretion. All the past generations of her tribe have built upon natural and, therefore, neutral sites, usually under shelving and overhanging rocks, and the art of adapting the nest to its surroundings, blending it with them, has been highly developed. But phœbe now frequently builds under our sheds and porches, where, so far as concealment is concerned, a change of material, say from moss to dry grass or shreds of bark, would be an advantage to her ; but she departs not a bit from the family traditions ; she uses the same woodsy mosses, which in some cases, especially when the nest is placed upon newly sawed timber, make her secret an open one to all eyes.

It does indeed often look as if the birds had very little sense. Think of a bluebird, or an oriole, or a robin, or a jay, fighting for hours at a time its own image as reflected in a pane of glass ; quite exhaust-

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ing itself in its fury to demolish its supposed rival! Yet I have often witnessed this little comedy. It is another instance of how the arts of our civilization corrupt and confuse the birds. It may be that in the course of many generations the knowledge of glass will get into their blood, and they will cease to be fooled by it, as they may also in time learn what a poor foundation the newspaper is to build upon. The ant or the bee could not be fooled by the glass in that way for a moment.

Have the birds and our other wild neighbors sense, as distinguished from instinct? Is a change of habits to meet new conditions, or the taking advantage of accidental circumstances, an evidence of sense? How many birds appear to have taken advantage of the protection afforded by man in building their nests! How many of them build near paths and along roadsides, to say nothing of those that come close to our dwellings! Even the quail seems to prefer the borders of the highway to the open fields. I have chanced upon only three quails' nests, and these were all by the roadside. One season a scarlet tanager that had failed with her first nest in the woods came to try again in a little cherry tree that stood in the open, a few feet from my cabin, where I could almost touch the nest with my hand as I passed. But in my absence she again came to grief, some marauder, probably a red squirrel, taking her eggs. Will her failure in

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this case cause her to lose faith in the protective influence of the shadow of a human dwelling? I hope not. I have known the turtle dove to make a similar move, occupying an old robin's nest near my neighbor's cottage. The timid rabbit will sometimes come up from the bushy fields and excavate a place for her nest in the lawn a few feet from the house. All such things look like acts of judgment, though they may be only the result of a greater fear overcoming a lesser fear.

It is in the preservation of their lives and of their young that the wild creatures come the nearest to showing what we call sense or reason. The boys tell me that a rabbit that has been driven from her hole a couple of times by a ferret will not again run into it when pursued. The tragedy of a rabbit pursued by a mink or a weasel may often be read upon our winter snows. The rabbit does not take to her hole; it would be fatal. And yet, though capable of far greater speed, so far as I have observed, she does not escape the mink; he very soon pulls her down. It would look as though a fatal paralysis, the paralysis of utter fear, fell upon the poor creature as soon as she found herself hunted by this subtle, blood-thirsty enemy. I have seen upon the snow where her jumps had become shorter and shorter, with tufts of fur marking each stride, till the bloodstains, and then her half-devoured body, told the whole tragic story.

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There is probably nothing in human experience, at this age of the world, that is like the helpless terror that seizes the rabbits as it does other of our lesser wild creatures, when pursued by any of the weasel tribe. They seem instantly to be under some fatal spell which binds their feet and destroys their will power. It would seem as if a certain phase of nature from which we get our notions of fate and cruelty had taken form in the weasel.

The rabbit, when pursued by the fox or by the dog, quickly takes to hole. Hence, perhaps, the wit of the fox that a hunter told me about. The story was all written upon the snow. A mink was hunting a rabbit, and the fox, happening along, evidently took in the situation at a glance. He secreted himself behind a tree or a rock, and, as the rabbit came along, swept her from her course like a charge of shot fired at close range, hurling her several feet over the snow, and then seizing her and carrying her to his den up the mountain-side.

It would be interesting to know how long our chimney swifts saw the open chimney-stacks of the early settlers beneath them before they abandoned the hollow trees in the woods and entered the chimneys for nesting and roosting purposes. Was the act an act of judgment, or simply an unreasoning impulse, like so much else in the lives of the wild creatures?

In the choice of nesting-material the swift shows

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no change of habit. She still snips off the small dry twigs from the tree-tops and glues them together, and to the side of the chimney, with her own glue. The soot is a new obstacle in her way, that she does not yet seem to have learned to overcome, as the rains often loosen it and cause her nest to fall to the bottom. She has a pretty way of trying to frighten you off when your head suddenly darkens the opening above her. At such times she leaves the nest and clings to the side of the chimney near it. Then, slowly raising her wings, she suddenly springs out from the wall and back again, making as loud a drumming with them in the passage as she is capable of. If this does not frighten you away, she repeats it three or four times. If your face still hovers above her, she remains quiet and watches you.

What a creature of the air this bird is, never touching the ground, so far as I know, and never tasting earthly food! The swallow does perch now and then and descend to the ground for nesting-material; but the swift, I have reason to believe, even outrides the summer storms, facing them on steady wing, high in air. The twigs for her nest she gathers on the wing, sweeping along like children on a "merry-go-round" who try to seize a ring, or to do some other feat, as they pass a given point. If the swift misses the twig, or it fails to yield to her the first time, she tries again and again, each time making a wider circuit, as if to tame and train her steed

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a little and bring him up more squarely to the mark next time.

The swift is a stiff flyer: there appear to be no joints in her wings; she suggests something made of wires or of steel. Yet the air of frolic and of superabundance of wing-power is more marked with her than with any other of our birds. Her feeding and twig-gathering seem like asides in a life of endless play. Several times both in spring and fall I have seen swifts gather in immense numbers toward night-fall, to take refuge in large unused chimney-stacks. On such occasions they seem to be coming together for some aerial festival or grand celebration; and, as if bent upon a final effort to work off a part of their superabundant wing-power before settling down for the night, they circle and circle high above the chimney-top, a great cloud of them, drifting this way and that, all in high spirits and chippering as they fly. Their numbers constantly increase as other members of the clan come dashing in from all points of the compass. Swifts seem to materialize out of empty air on all sides of the chippering, whirling ring, as an hour or more this assembling of the clan and this flight festival go on. The birds must gather in from whole counties, or from half a State. They have been on the wing all day, and yet now they seem as tireless as the wind, and as if unable to curb their powers.

One fall they gathered in this way and took refuge

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for the night in a large chimney-stack in a city near me, for more than a month and a half. Several times I went to town to witness the spectacle, and a spectacle it was: ten thousand of them, I should think, filling the air above a whole square like a whirling swarm of huge black bees, but saluting the ear with a multitudinous chippering, instead of a humming. People gathered upon the sidewalks to see them. It was a rare circus performance, free to all. After a great many feints and playful approaches, the whirling ring of birds would suddenly grow denser above the chimney ; then a stream of them, as if drawn down by some power of suction, would pour into the opening. For only a few seconds would this downward rush continue; then, as if the spirit of frolic had again got the upper hand of them, the ring would rise, and the chippering and circling go on. In a minute or two the same manœuvre would be repeated, the chimney, as it were, taking its swallows at intervals to prevent choking. It usually took a half-hour or more for the birds all to disappear down its capacious throat. There was always an air of timidity and irresolution about their approach to the chimney, just as there always is about their approach to the dead tree-top from which they procure their twigs for nest-building. Often did I see birds hesitate above the opening and then pass on, apparently as though they had not struck it at just the right angle. On one occasion a solitary bird

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was left flying, and it took three or four trials either to make up its mind or to catch the trick of the descent. On dark or threatening or stormy days the birds would begin to assemble by mid-afternoon, and by four or five o'clock were all in their lodgings.

The chimney is a capacious one, forty or fifty feet high and nearly three feet square, yet it did not seem adequate to afford breathing-space for so many birds. I was curious to know how they disposed themselves inside. At the bottom was a small opening. Holding my ear to it, I could hear a continuous chirping and humming, as if the birds were still all in motion, like an agitated beehive. At nine o'clock this multitudinous sound of wings and voices was still going on, and doubtless it was kept up all night. What was the meaning of it? Was the press of birds so great that they needed to keep their wings moving to ventilate the shaft, as do certain of the bees in a crowded hive? Or were these restless spirits unable to fold their wings even in sleep? I was very curious to get a peep inside that chimney when the swifts were in it. So one afternoon this opportunity was afforded me by the removal of the large smoke-pipe of the old steam-boiler. This left an opening into which I could thrust my head and shoulders. The sound of wings and voices filled the hollow shaft. On looking up, I saw the sides of the chimney for about half its length paved with the restless birds; they sat so close together that their

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bodies touched. Moreover, a large number of them were constantly on the wing, showing against the sky light as if they were leaving the chimney. But they did not leave it. They rose up a few feet and then resumed their positions upon the sides, and it was this movement that caused the humming sound. All the while the droppings of the birds came down like a summer shower. At the bottom of the shaft was a mine of guano three or four feet deep, with a dead swift here and there upon it. Probably one or more birds out of such a multitude died every night. I had fancied there would be many more. It was a long time before it dawned upon me what this uninterrupted flight within the chimney meant. Finally I saw that it was a sanitary measure: only thus could the birds keep from soiling each other with their droppings. Birds digest very rapidly, and had they all continued to cling to the sides of the wall, they would have been in a sad predicament before morning. Like other acts of cleanliness on the part of birds, this was doubtless the prompting of instinct and not of judgment. It was Nature looking out for her own.

In view, then, of the doubtful sense or intelligence of the wild creatures, what shall we say of the new school of nature writers or natural history romancers that has lately arisen, and that reads into the birds and animals almost the entire human psychology? This, surely: so far as these writers awaken an

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interest in the wild denizens of the field and wood, and foster a genuine love of them in the hearts of the young people, so far is their influence good; but so far as they pervert natural history and give false impressions of the intelligence of our animals, catering to a taste that prefers the fanciful to the true and the real, is their influence bad. Of course the great army of readers prefer this sugar-coated natural history to the real thing, but the danger always is that an indulgence of this taste will take away a liking for the real thing, or prevent its development. The knowing ones, those who can take these pretty tales with the pinch of salt of real knowledge, are not many; the great majority are simply entertained while they are being humbugged. There may be no very serious objection to the popular love of sweets being catered to in this field by serving up the life-history of our animals in a story, all the missing links supplied, and all their motives and acts humanized, provided it is not done covertly and under the guise of a real history. We are never at a loss how to take Kipling in his "Jungle Book;" we are pretty sure that this is fact dressed up as fiction, and that much of the real life of the jungle is in these stories. I remember reading his story of "The White Seal" shortly after I had visited the Seal Islands in Bering Sea, and I could not detect in the story one departure from the facts of the life-history of the seal, so far as it is known. Kipling takes no covert liberties with

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natural history, any more than he does with the facts of human history in his novels.

Unadulterated, unsweetened observations are what the real nature-lover craves. No man can invent incidents and traits as interesting as the reality. Then, to know that a thing is true gives it such a savor! The truth — how we do crave the truth! We cannot feed our minds on simulacra any more than we can our bodies. Do assure us that the thing you tell is true. If you must counterfeit the truth, do it so deftly that we shall never detect you. But in natural history there is no need to counterfeit the truth; the reality always suffices, if you have eyes to see it and ears to hear it. Behold what Maeterlinck makes out of the life of the bee, simply by getting at and portraying the facts — a true wonder-book, the enchantment of poetry wedded to the authority of science.

Works on animal intelligence, such as Romanes's, abound in incidents that show in the animals reason and forethought in their simpler forms; but in many cases the incidents related in these works are not well authenticated, nor told by trained observers. The observations of the great majority of people have no scientific value whatever. Romanes quotes from some person who alleges that he saw a pair of nightingales, during a flood in the river near which their nest was placed, pick up the nest bodily and carry it to a place of safety. This is incredible. If

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Romanes himself or Darwin himself said he saw this, one would have to believe it. Birds whose nests have been plundered sometimes pull the old nest to pieces and use the material, or parts of it, in building a new nest; but I cannot believe that any pair of birds ever picked up a nest containing eggs and carried it off to a new place. How could they do it? With one on each side, how could they fly with the nest between them? They could not carry it with their feet, and how could they manage it with their beaks?

My neighbor met in the woods a black snake that had just swallowed a red squirrel. Now your romance-naturalist may take such a fact as this and make as pretty a story of it as he can. He may ascribe to the snake and his victim all the human emotions he pleases. He may make the snake glide through the tree-tops from limb to limb, and from tree to tree, in pursuit of its prey: the main thing is, the snake got the squirrel. If our romancer makes the snake fascinate the squirrel, I shall object, because I don't believe that snakes have this power. People like to believe that they have. It would seem as if this subtle, gliding, hateful creature ought to have some such mysterious gift, but I have no proof that it has. Every year I see the black snake robbing birds'-nests, or pursued by birds whose nests it has just plundered, but I have yet to see it cast its fatal spell upon a grown bird. Or, if our romancer says that the black snake was drilled in the art of squir-

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rel-catching by its mother, I shall know he is a pretender.

Speaking of snakes reminds me of an incident I have several times witnessed in our woods in connection with a snake commonly called the sissing or blowing adder. When I have teased this snake a few moments with my cane, it seems to be seized with an epileptic or cataleptic fit. It throws itself upon its back, coiled nearly in the form of a figure eight, and begins a series of writhings and twistings and convulsive movements astonishing to behold. Its mouth is open and presently full of leaf-mould, its eyes are covered with the same, its head is thrown back, its white belly up; now it is under the leaves, now out, the body all the while being rapidly drawn through this figure eight, so that the head and tail are constantly changing place. What does it mean? Is it fear? Is it a real fit? I do not know, but any one of our romance-naturalists could tell you at once. I can only suggest that it may be a ruse to baffle its enemy, the black snake, when he would attempt to crush it in his folds, or to seize its head when he would swallow it.

I am reminded of another mystery connected with a snake, or a snake-skin, and a bird. Why does our great crested flycatcher weave a snake-skin into its nest, or, in lieu of that, something that suggests a snake-skin, such as an onion-skin, or fish-scales, or a bit of oiled paper? It is thought by some persons

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that it uses the snake-skin as a kind of scarecrow, to frighten away its natural enemies. But think what this purpose in the use of it would imply. It would imply that the bird knew that there were among its enemies creatures that were afraid of snakes — so afraid of them that one of their faded and cast-off skins would keep these enemies away. How could the bird obtain this knowledge? It is not afraid of the skin itself; why should it infer that squirrels, for instance, are? I am convinced there is nothing in this notion. In all the nests that have come under my observation, the snake-skin was in faded fragments woven into the texture of the nest, and one would not be aware of its presence unless he pulled the nest to pieces. True, Mr. Frank Bolles reports finding a nest of this bird with a whole snake-skin coiled around a single egg; but it was the skin of a small garter-snake, six or seven inches long, and could not therefore have inspired much terror in the heart of the bird's natural enemies. Dallas Lore Sharp, author of that delightful book, "Wild Life Near Home," tells me he has seen a whole skin dangling nearly its entire length from the hole that contained the nest, just as he has seen strings hanging from the nest of the kingbird. The bird was too hurried or too careless to pull in the skin. Mr. Sharp adds that he cannot "give the bird credit for appreciating the attitude of the rest of the world toward snakes, and making use of the fear." More

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over, a cast-off snake-skin looks very little like a snake. It is thin, shrunken, faded, papery, and there is no terror in it. Then, too, it is dark in the cavity of the nest, consequently the skin could not serve as a scarecrow in any case. Hence, whatever its purpose may be, it surely is not that. It looks like a mere fancy or whim of the bird. There is that in its voice and ways that suggests something a little uncanny. Its call is more like the call of the toad than that of a bird. If the toad did not always swallow its own cast-off skin, the bird would probably use that too.

At the best we can only guess at the motives of the birds and beasts. As I have elsewhere said, they nearly all have reference in some way to the self-preservation of these creatures. But how the bits of an old snake-skin in a bird's nest can contribute specially to this end, I cannot see.

Nature is not always consistent; she does not always choose the best means to a given end. For instance, all the wrens except our house wren seem to use about the best material at hand for their nests. What can be more unsuitable, untractable, for a nest in a hole or cavity than the twigs the house wren uses? Dry grasses or bits of soft bark would bend and adapt themselves easily to the exigencies of the case; but stiff, unyielding twigs! What a contrast to the suitability of the material the hummingbird uses — the down of some plant, which seems to have a poetic fitness!

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Yesterday in my walk I saw where a red squirrel had stripped the soft outer bark off a group of red cedars to build its winter's nest with. This also seemed fit, — fit that such a creature of the trees should not go to the ground for its nest-material, and should choose something soft and pliable. Among the birches, it probably gathers the fine curling shreds of the birch bark.

Beside my path in the woods a downy woodpecker, late one fall, drilled a hole in the top of a small dead black birch for his winter quarters. My attention was first called to his doings by the white chips upon the ground. Every day as I passed I would rap upon his tree, and if he was in he would appear at his door and ask plainly enough what I wanted now. One day when I rapped, something else appeared at the door — I could not make out what. I continued my rapping, when out came two flying-squirrels. On the tree being given a vigorous shake, it broke off at the hole, and the squirrels went sliding down the air to the foot of a hemlock, up which they disappeared. They had dispossessed Downy of his house, had carried in some grass and leaves for a nest, and were as snug as a bug in a rug. Downy drilled another cell in a dead oak farther up the hill, and, I hope, passed the winter there unmolested. Such incidents, comic or tragic, as they chance to strike us, are happening all about us, if we have eyes to see them.

The next season, near sundown of a late Novem-

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ber day, I saw Downy trying to get possession of a hole not his own. I chanced to be passing under a maple, when white chips upon the ground again caused me to scrutinize the branches overhead. Just then I saw Downy come to the tree, and, hopping around on the under side of a large dry limb, begin to make passes at something with his beak. Presently I made out a round hole there, with something in it returning Downy's thrusts. The sparring continued some moments. Downy would hop away a few feet, then return to the attack, each time to be met by the occupant of the hole. I suspected an English sparrow had taken possession of Downy's cell in his absence during the day, but I was wrong. Downy flew to another branch, and I tossed up a stone against the one that contained the hole, when, with a sharp, steely note, out came a hairy woodpecker and alighted on a near-by branch. Downy, then, had the "cheek" to try to turn his large rival out of doors — and it was Hairy's cell, too; one could see that by the size of the entrance. Thus loosely does the rule of *meum* and *tuum* obtain in the woods. There is no moral code in nature. Might reads right. Man in communities has evolved ethical standards of conduct, but nations, in their dealings with one another, are still largely in a state of savage nature, and seek to establish the right, as dogs do, by the appeal to battle.

One season a wood duck laid her eggs in a cavity

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in the top of a tall yellow birch near the spring that supplies my cabin with water. A bold climber "shinned" up the fifty or sixty feet of rough tree-trunk and looked in upon the eleven eggs. They were beyond the reach of his arm, in a well-like cavity over three feet deep. How would the mother duck get her young up out of that well and down to the ground? We watched, hoping to see her in the act. But we did not. She may have done it at night or very early in the morning. All we know is that when Amasa one morning passed that way, there sat eleven little tufts of black and yellow down in the spring, with the mother duck near by. It was a pretty sight. The feat of getting down from the tree-top cradle had been safely effected, probably by the young clambering up on the inside walls of the cavity and then tumbling out into the air and coming down gently like huge snowflakes. They are mostly down, and why should they not fall without any danger to life or limb? The notion that the mother duck takes the young one by one in her beak and carries them to the creek is doubtless erroneous. Mr. William Brewster once saw the golden-eye, whose habits of nesting are like those of the wood duck, get its young from the nest to the water in this manner: The mother bird alighted in the water under the nest, looked all around to see that the coast was clear, and then gave a peculiar call. Instantly the young shot out of the cavity that held

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them, as if the tree had taken an emetic, and came softly down to the water beside their mother. Another observer assures me that he once found a newly hatched duckling hung by the neck in the fork of a bush under a tree in which a brood of wood ducks had been hatched.

The ways of nature, — who can map them, or fathom them, or interpret them, or do much more than read a hint correctly here and there? Of one thing we may be pretty certain, namely, that the ways of wild nature may be studied in our human ways, inasmuch as the latter are an evolution from the former, till we come to the ethical code, to altruism and self-sacrifice. Here we seem to breathe another air, though probably this code differs no more from the animal standards of conduct than our physical atmosphere differs from that of early geologic time.

Our moral code must in some way have been evolved from our rude animal instincts. It came from within; its possibilities were all in nature. If not, where were they?

I have seen disinterested acts among the birds, or what looked like such, as when one bird feeds the young of another species when it hears them crying for food. But that a bird would feed a grown bird of another species, or even of its own, to keep it from starving, I have my doubts. I am quite positive that mice will try to pull one of their fellows out of a

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trap, but what the motive is, who shall say? Would the same mice share their last crumb with their fellow if he were starving? That, of course, would be a much nearer approach to the human code, and is too much to expect. Bees will clear their fellows of honey, but whether it be to help them, or to save the honey, is a question.

In my youth I saw a parent weasel seize one of its nearly grown young which I had wounded and carry it across an open barway, in spite of my efforts to hinder it. A friend of mine, who is a careful observer, says he once wounded a shrike so that it fell to the ground, but before he got to it, it recovered itself and flew with difficulty toward some near trees, calling to its mate the while; the mate came and seemed to get beneath the wounded bird and buoy it up, so aiding it that it gained the top of a tall tree, where my friend left it. But in neither instance can we call this helpfulness entirely disinterested, or pure altruism.

Emerson said that he was an endless experimenter with no past at his back. This is just what Nature is. She experiments endlessly, seeking new ways, new modes, new forms, and is ever intent upon breaking away from the past. In this way, as Darwin showed, she attains to new species. She is blind, she gropes her way, she trusts to luck; all her successes are chance hits. Whenever I look over my right shoulder, as I sit at my desk writing these sentences, I see

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a long shoot of a honeysuckle that came in through a crack of my imperfectly closed window last summer. It came in looking, or rather feeling, for something to cling to. It first dropped down upon a pile of books, then reached off till it struck the window-sill of another large window; along this it crept, its regular leaves standing up like so many pairs of green ears, looking very pretty. Coming to the end of the open way there, it turned to the left and reached out into vacancy, till it struck another window-sill running at right angles to the former; along this it traveled nearly half an inch a day, till it came to the end of that road. Then it ventured out into vacant space again, and pointed straight toward me at my desk, ten feet distant. Day by day it kept its seat upon the window-sill, and stretched out farther and farther, almost beckoning me to give it a lift or to bring it support. I could hardly resist its patient daily appeal. Late in October it had bridged about three feet of the distance that separated us, when, one day, the moment came when it could maintain itself outright in the air no longer, and it fell to the floor. "Poor thing," I said, "your faith was blind, but it was real. You knew there was a support somewhere, and you tried all ways to find it." This is Nature. She goes around the circle, she tries every direction, sure that she will find a way at some point. Animals in cages behave in a similar way, looking for a means of escape. In the vineyard I

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see the grape-vines reaching out blindly in all directions for some hold for their tendrils. The young arms seize upon one another and tighten their hold as if they had at last found what they were in search of. Stop long enough beside one of the vines, and it will cling to you and run all over you.

Behold the tumble-bug with her ball of dung by the roadside; where is she going with it? She is going anywhere and everywhere; she changes her direction, like the vine, whenever she encounters an obstacle. She only knows that somewhere there is a depression or a hole in which her ball with its egg can rest secure, and she keeps on tumbling about till she finds it, or maybe digs one, or comes to grief by the foot of some careless passer-by. This, again, is Nature's way, randomly and tirelessly seeking her ends. When we look over a large section of history, we see that it is man's way, too, or Nature's way in man. His progress has been a blind groping, the result of endless experimentation, and all his failures and mistakes could not be written in a book. How he has tumbled about with his ball, seeking the right place for it, and how many times has he come to grief! All his successes have been lucky hits: steam, electricity, representative government, printing — how long he groped for them before he found them! There is always and everywhere the Darwinian tendency to variation, to seek new forms, to improve upon the past; and man is under this

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law, the same as is the rest of nature. One generation of men, like one generation of leaves, becomes the fertilizer of the next; failures only enrich the soil or make smoother the way.

There are so many conflicting forces and interests, and the conditions of success are so complex! If the seed fall here, it will not germinate; if there, it will be drowned or washed away; if yonder, it will find too sharp competition. There are only a few places where it will find all the conditions favorable. Hence the prodigality of Nature in seeds, scattering a thousand for one plant or tree. She is like a hunter shooting at random into every tree or bush, hoping to bring down his game, which he does if his ammunition holds out long enough; or like the British soldier in the Boer War, firing vaguely at an enemy that he does not see. But Nature's ammunition always holds out, and she hits her mark in the end. Her ammunition on our planet is the heat of the sun. When this fails, she will no longer hit the mark or try to hit it.

Let there be a plum tree anywhere with the disease called the "black-knot" upon it, and presently every plum tree in its neighborhood will have black knots. Do you think the germs from the first knot knew where to find the other plum trees? No; the wind carried them in every direction, where the plum trees were not as well as where they were. It was a blind search and a chance hit. So with all

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seeds and germs. Nature covers all the space, and is bound to hit the mark sooner or later. The sun spills his light indiscriminately into space; a small fraction of his rays hit the earth, and we are warmed. Yet to all intents and purposes it is as if he shone for us alone.

III

BIRD-SONGS

I SUSPECT it requires a special gift of grace to enable one to hear the bird-songs; some new power must be added to the ear, or some obstruction removed. There are not only scales upon our eyes so that we do not see, there are scales upon our ears so that we do not hear. A city woman who had spent much of her time in the country once asked a well-known ornithologist to take her where she could hear the bluebird. "What, never heard the bluebird!" said he. "I have not," said the woman. "Then you will never hear it," said the bird-lover; never hear it with that inward ear that gives beauty and meaning to the note. He could probably have taken her in a few minutes where she could have heard the call or warble of the bluebird; but it would have fallen upon unresponsive ears — upon ears that were not sensitized by love for the birds or associations with them. Bird-songs are not music, properly speaking, but only suggestions of music. A great many people whose attention would be quickly arrested by the same volume of sound made by a musical instrument or by artificial means never

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hear them at all. The sound of a boy's penny whistle there in the grove or the meadow would separate itself more from the background of nature, and be a greater challenge to the ear, than is the strain of the thrush or the song of the sparrow. There is something elusive, indefinite, neutral, about bird-songs that makes them strike obliquely, as it were, upon the ear ; and we are very apt to miss them. They are a part of nature, the Nature that lies about us, entirely occupied with her own affairs, and quite regardless of our presence. Hence it is with bird-songs as it is with so many other things in nature — they are what we make them ; the ear that hears them must be half creative. I am always disturbed when persons not especially observant of birds ask me to take them where they can hear a particular bird, in whose song they have become interested through a description in some book. As I listen with them, I feel like apologizing for the bird : it has a bad cold, or has just heard some depressing news ; it will not let itself out. The song seems so casual and minor when you make a dead set at it. I have taken persons to hear the hermit thrush, and I have fancied that they were all the time saying to themselves, "Is that all ?" But should one hear the bird in his walk, when the mind is attuned to simple things and is open and receptive, when expectation is not aroused and the song comes as a surprise out of the dusky silence of the

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woods, then one feels that it merits all the fine things that can be said of it.

One of our popular writers and lecturers upon birds told me this incident: He had engaged to take two city girls out for a walk in the country, to teach them the names of the birds they might see and hear. Before they started, he read to them Henry van Dyke's poem on the song sparrow, — one of our best bird-poems, — telling them that the song sparrow was one of the first birds they were likely to hear. As they proceeded with their walk, sure enough, there by the roadside was a sparrow in song. The bird man called the attention of his companions to it. It was some time before the unpracticed ears of the girls could make it out; then one of them said (the poem she had just heard, I suppose, still ringing in her ears), "What! that little squeaky thing?" The sparrow's song meant nothing to her at all, and how could she share the enthusiasm of the poet? Probably the warble of the robin, or the call of the meadowlark or of the highhole, if they chanced to hear them, meant no more to these girls. If we have no associations with these sounds, they will mean very little to us. Their merit as musical performances is very slight. It is as signs of joy and love in nature, as heralds of spring, and as the spirit of the woods and fields made audible, that they appeal to us. The drumming of the woodpeckers and of the ruffed grouse give great

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pleasure to a countryman, though these sounds have not the quality of real music. It is the same with the call of the migrating geese or the voice of any wild thing : our pleasure in them is entirely apart from any considerations of music. Why does the wild flower, as we chance upon it in the woods or bogs, give us more pleasure than the more elaborate flower of the garden or lawn ? Because it comes as a surprise, offers a greater contrast with its surroundings, and suggests a spirit in wild nature that seems to take thought of itself and to aspire to beautiful forms.

The songs of caged birds are always disappointing, because such birds have nothing but their musical qualities to recommend them to us. We have separated them from that which gives quality and meaning to their songs. One recalls Emerson's lines : —

“ I thought the sparrow's note from heaven,
Singing at dawn on the alder bough;
I brought him home, in his nest, at even;
He sings the song, but it cheers not now,
For I did not bring home the river and sky; —
He sang to my ear, — they sang to my eye.”

I have never yet seen a caged bird that I wanted, — at least, not on account of its song, — nor a wild flower that I wished to transfer to my garden. A caged skylark will sing its song sitting on a bit of

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turf in the bottom of the cage; but you want to stop your ears, it is so harsh and sibilant and penetrating. But up there against the morning sky, and above the wide expanse of fields, what delight we have in it! It is not the concord of sweet sounds: it is the soaring spirit of gladness and ecstasy raining down upon us from "heaven's gate."

Then, if to the time and the place one could only add the association, or hear the bird through the vista of the years, the song touched with the magic of youthful memories! One season a friend in England sent me a score of skylarks in a cage. I gave them their liberty in a field near my place. They drifted away, and I never heard them or saw them again. But one Sunday a Scotchman from a neighboring city called upon me, and declared with visible excitement that on his way along the road he had heard a skylark. He was not dreaming; he knew it was a skylark, though he had not heard one since he had left the banks of the Doon, a quarter of a century or more before. What pleasure it gave him! How much more the song meant to him than it would have meant to me! For the moment he was on his native heath again. Then I told him about the larks I had liberated, and he seemed to enjoy it all over again with renewed appreciation.

Many years ago some skylarks were liberated on Long Island, and they became established there, and may now occasionally be heard in certain localities.

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One summer day a friend of mine was out there observing them; a lark was soaring and singing in the sky above him. An old Irishman came along, and suddenly stopped as if transfixed to the spot; a look of mingled delight and incredulity came into his face. Was he indeed hearing the bird of his youth? He took off his hat, turned his face skyward, and with moving lips and streaming eyes stood a long time regarding the bird. "Ah," my friend thought, "if I could only hear that song with his ears!" How it brought back his youth and all those long-gone days on his native hills!

The power of bird-songs over us is so much a matter of association that every traveler to other countries finds the feathered songsters of less merit than those he left behind. The stranger does not hear the birds in the same receptive, uncritical frame of mind as does the native; they are not in the same way the voices of the place and the season. What music can there be in that long, piercing, far-heard note of the first meadowlark in spring to any but a native, or in the "o-ka-lee" of the red-shouldered starling as he rests upon the willows in March? A stranger would probably recognize melody and a wild woodsy quality in the flutings of the veery thrush; but how much more they would mean to him after he had spent many successive Junes threading our northern trout-streams and encamping on their banks! The veery will come early in

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the morning, and again at sundown, and perch above your tent, and blow his soft, reverberant note for many minutes at a time. The strain repeats the echoes of the limpid stream in the halls and corridors of the leafy woods.

While in England in 1882, I rushed about two or three counties in late June and early July, bent on hearing the song of the nightingale, but missed it by a few days, and in some cases, as it seemed, only by a few hours. The nightingale seems to be wound up to go only so long, or till about the middle of June, and it is only by a rare chance that you hear one after that date. Then I came home to hear a nightingale in song one winter morning in a friend's house in the city. It was a curious let-down to my enthusiasm. A caged song in a city chamber in broad daylight, in lieu of the wild, free song in the gloaming of an English landscape! I closed my eyes, abstracted myself from my surroundings, and tried my best to fancy myself listening to the strain back there amid the scenes I had haunted about Haslemere and Godalming, but with poor success, I suspect. The nightingale's song, like the lark's, needs vista, needs all the accessories of time and place. The song is not all in the singing, any more than the wit is all in the saying. It is in the occasion, the surroundings, the spirit of which it is the expression. My friend said that the bird did not fully let itself out. Its song was a brilliant medley of notes, — no

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theme that I could detect, — like the lark's song in this respect; all the notes of the field and forest appeared to be the gift of this bird, but what tone! what accent! like that of a great poet!

Nearly every May I am seized with an impulse to go back to the scenes of my youth, and hear the bobolinks in the home meadows once more. I am sure they sing there better than anywhere else. They probably drink nothing but dew, and the dew distilled in those high pastoral regions has surprising virtues. It gives a clear, full, vibrant quality to the birds' voices that I have never heard elsewhere. The night of my arrival, I leave my southern window open, so that the meadow chorus may come pouring in before I am up in the morning. How it does transport me athwart the years, and make me a boy again, sheltered by the paternal wing! On one occasion, the third morning after my arrival, a bobolink appeared with a new note in his song. The note sounded like the word "baby" uttered with a peculiar, tender resonance: but it was clearly an interpolation; it did not belong there; it had no relation to the rest of the song. Yet the bird never failed to utter it with the same joy and confidence as the rest of his song. Maybe it was the beginning of a variation that will in time result in an entirely new bobolink song.

On my last spring visit to my native hills, my attention was attracted to another songster not seen

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or heard there in my youth, namely, the prairie horned lark. Flocks of these birds used to be seen in some of the Northern States in the late fall during their southern migrations; but within the last twenty years they have become regular summer residents in the hilly parts of many sections of New York and New England. They are genuine skylarks, and lack only the powers of song to make them as attractive as their famous cousins of Europe.

The larks are ground-birds when they perch, and sky-birds when they sing; from the turf to the clouds — nothing between. Our horned lark mounts upward on quivering wing in the true lark fashion, and, spread out against the sky at an altitude of two or three hundred feet, hovers and sings. The watcher and listener below holds him in his eye, but the ear catches only a faint, broken, half-inarticulate note now and then — mere splinters, as it were, of the song of the skylark. The song of the latter is continuous, and is loud and humming; it is a fountain of jubilant song up there in the sky: but our lark sings in snatches; at each repetition of its notes it dips forward and downward a few feet, and then rises again. One day I kept my eye upon one until it had repeated its song one hundred and three times; then it closed its wings, and dropped toward the earth like a plummet, as does its European congener. While I was watching the bird, a bobolink flew over my head, between me and the lark, and

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poured out his voluble and copious strain. "What a contrast," I thought, "between the voice of the spluttering, tongue-tied lark, and the free, liquid, and varied song of the bobolink!"

I have heard of a curious fact in the life-histories of these larks in the West. A Michigan woman once wrote me that her brother, who was an engineer on an express train that made daily trips between two Western cities, reported that many birds were struck by the engine every day, and killed — often as many as thirty on a trip of sixty miles. Birds of many kinds were killed, but the most common was a bird that went in flocks, the description of which answered to the horned lark. Since then I have read in a Minnesota newspaper that many horned larks are killed by railroad locomotives in that State. It was thought that the birds sat behind the rails to get out of the wind, and on starting up in front of the advancing train, were struck down by the engine. The Michigan engineer referred to thought that the birds gathered upon the track to earth their wings, or else to pick up the grain that leaks out of the wheat-trains, and sows the track from Dakota to the seaboard. Probably the wind which they might have to face in getting up was the prime cause of their being struck. One does not think of the locomotive as a bird-destroyer, though it is well known that many of the smaller mammals often fall beneath it.

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A very interesting feature of our bird-songs is the wing-song, or song of ecstasy. It is not the gift of many of our birds. Indeed, less than a dozen species are known to me as ever singing on the wing. It seems to spring from more intense excitement and self-abandonment than the ordinary song delivered from the perch. When its joy reaches the point of rapture, the bird is literally carried off its feet, and up it goes into the air, pouring out its song as a rocket pours out its sparks. The skylark and the bobolink habitually do this, while a few others of our birds do it only on occasions. One summer, up in the Catskills, I added another name to my list of ecstatic singers — that of the vesper sparrow. Several times I heard a new song in the air, and caught a glimpse of the bird as it dropped back to the earth. My attention would be attracted by a succession of hurried, chirping notes, followed by a brief burst of song, then by the vanishing form of the bird. One day I was lucky enough to see the bird as it was rising to its climax in the air, and to identify it as the vesper sparrow. The burst of song that crowned the upward flight of seventy-five or one hundred feet was brief; but it was brilliant and striking, and entirely unlike the leisurely chant of the bird while upon the ground. It suggested a lark, but was less buzzing or humming. The preliminary chirping notes, uttered faster and faster as the bird mounted in the air, were like the trail of sparks

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which a rocket emits before its grand burst of color at the top of its flight.

It is interesting to note that this bird is quite lark-like in its color and markings, having the two lateral white quills in the tail, and it has the habit of elevating the feathers on the top of the head so as to suggest a crest. The solitary skylark that I discovered several years ago in a field near me was seen on several occasions paying his addresses to one of these birds, but the vesper-bird was shy, and eluded all his advances.

Probably the perch-songster among our ordinary birds that is most regularly seized with the fit of ecstasy that results in this lyric burst in the air, as I described in my first book, "Wake Robin," over thirty years ago, is the oven-bird, or wood-accentor — the golden-crowned thrush of the old ornithologists. Every loiterer about the woods knows this pretty, speckled-breasted, olive-backed little bird, which walks along over the dry leaves a few yards from him, moving its head as it walks, like a miniature domestic fowl. Most birds are very stiff-necked, like the robin, and as they run or hop upon the ground, carry the head as if it were riveted to the body. Not so the oven-bird, or the other birds that walk, as the cow-bunting, or the quail, or the crow. They move the head forward with the movement of the feet. The sharp, reiterated, almost screeching song of the oven-bird, as it perches on a limb a

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few feet from the ground, like the words, "preacher, preacher, preacher," or "teacher, teacher, teacher," uttered louder and louder, and repeated six or seven times, is also familiar to most ears; but its wild, ringing, rapturous burst of song in the air high above the tree-tops is not so well known. From a very prosy, tiresome, unmelodious singer, it is suddenly transformed for a brief moment into a lyric poet of great power. It is a great surprise. The bird undergoes a complete transformation. Ordinarily it is a very quiet, demure sort of bird. It walks about over the leaves, moving its head like a little hen; then perches on a limb a few feet from the ground and sends forth its shrill, rather prosy, unmusical chant. Surely it is an ordinary, commonplace bird. But wait till the inspiration of its flight-song is upon it. What a change! Up it goes through the branches of the trees, leaping from limb to limb, faster and faster, till it shoots from the tree-tops fifty or more feet into the air above them, and bursts into an ecstasy of song, rapid, ringing, lyrical; no more like its habitual performance than a match is like a rocket; brief but thrilling; emphatic but musical. Having reached its climax of flight and song, the bird closes its wings and drops nearly perpendicularly downward like the skylark. If its song were more prolonged, it would rival the song of that famous bird. The bird does this many times a day during early June, but

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oftenest at twilight. The song in quality and general cast is like that of its congener, the water-accentor, which, however, I believe is never delivered on the wing. From its habit of singing at twilight, and from the swift, darting motions of the bird, I am inclined to think that in it we have solved the mystery of Thoreau's "night-warbler," that puzzled and eluded him for years. Emerson told him he must beware of finding and booking it, lest life should have nothing more to show him. The older ornithologists must have heard this song many times, but they never seem to have suspected the identity of the singer.

Other birds that sing on the wing are the meadow-lark, goldfinch, purple finch, indigo-bird, Maryland yellow-throat, and woodcock. The flight-song of the woodcock I have heard but twice in my life. The first time was in the evening twilight about the middle of April. The bird was calling in the dusk "yeap, yeap," or "seap, seap," from the ground, — a peculiar reedy call. Then, by and by, it started upward on an easy slant, that peculiar whistling of its wings alone heard; then, at an altitude of one hundred feet or more, it began to float about in wide circles and broke out in an ecstatic chipper, almost a warble at times, with a peculiar smacking musical quality; then, in a minute or so, it dropped back to the ground again, not straight down like the lark, but more spirally, and continued its call as before. In less than five minutes it was up again. The

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next time, a few years later, I heard the song in company with a friend, Dr. Clara Barrus. Let me give the woman's impression of the song as she afterward wrote it up for a popular journal.

"The sunset light was flooding all this May loveliness of field and farm and distant wood; song sparrows were blithely pouring out happiness by the throatful; peepers were piping and toads trilling, and we thought it no hardship to wait in such a place till the dusk should gather, and the wary woodcock announce his presence. But hark! while yet 'tis light, only a few rods distant, I hear that welcome 'seap . . . seap,' and lo! a chipper and a chirr, and past us he flies, — a direct, slanting upward flight, somewhat labored, — his bill showing long against the reddened sky. 'He has something in his mouth,' I start to say, when I bethink me what a long bill he has. Around, above us he flies in wide, ambitious circles, the while we are enveloped, as it were, in that hurried chippering sound — fine, elusive, now near, now distant. How rapid is the flight! Now it sounds faster and faster, 'like a whiplash flashed through the air,' said my friend; up, up he soars, till he becomes lost to sight at the instant that his song ends in that last mad ecstasy that just precedes his alighting."

The meadowlark sings in a level flight, half hovering in the air, giving voice to a rapid medley of lark-like notes. The goldfinch also sings in a level flight, beating the air slowly with its wings broadly

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open, and pouring out its jubilant, ecstatic strain I think it indulges in this wing-song only in the early season. After the mother bird has begun sitting, the male circles about within earshot of her, in that curious undulating flight, uttering his "per-chic-o-pee, per-chic-o-pee," while the female calls back to him in the tenderest tones, "Yes, lovie; I hear you." The indigo-bird and the purple finch, when their happiness becomes too full and buoyant for them longer to control it, launch into the air, and sing briefly, ecstatically, in a tremulous, hovering flight. The air-song of these birds does not differ essentially from the song delivered from the perch, except that it betrays more excitement, and hence is a more complete lyrical rapture.

The purple finch is our finest songster among the finches. Its strain is so soft and melodious, and touched with such a childlike gayety and plaintiveness, that I think it might sound well even in a cage inside a room, if the bird would only sing with the same joyous abandonment, which, of course, it would not do.

It is not generally known that individual birds of the same species show different degrees of musical ability. This is often noticed in caged birds, among which the principle of variation seems more active; but an attentive observer notes the same fact in wild birds. Occasionally he hears one that in powers of song surpasses all its fellows. I have heard a sparrow,

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an oriole, and a wood thrush, each of which had a song of its own that far exceeded any other. I stood one day by a trout-stream, and suspended my fishing for several minutes to watch a song sparrow that was singing on a dry limb before me. He had five distinct songs, each as markedly different from the others as any human songs, which he repeated one after the other. He may have had a sixth or a seventh, but he bethought himself of some business in the next field, and flew away before he had exhausted his repertory. I once had a letter from Robert Louis Stevenson, who said he had read an account I had written of the song of the English blackbird. He said I might as well talk of the song of man; that every blackbird had its own song; and then he told me of a remarkable singer he used to hear somewhere amid the Scottish hills. But his singer was, of course, an exception; twenty-four blackbirds out of every twenty-five probably sing the same song, with no appreciable variations: but the twenty-fifth may show extraordinary powers. I told Stevenson that his famous singer had probably been to school to some nightingale on the Continent or in southern England. I might have told him of the robin I once heard here that sang with great spirit and accuracy the song of the brown thrasher, or of another that had the note of the whip-poor-will interpolated in the regular robin song, or of still another that had the call of the quail. In each case

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the bird had probably heard the song and learned it while very young. In the Trossachs, in Scotland, I followed a song thrush about for a long time, attracted by its peculiar song. It repeated over and over again three or four notes of a well-known air, which it might have caught from some shepherd boy whistling to his flock or to his cow.

The songless birds — why has Nature denied them this gift? But they nearly all have some musical call or impulse that serves them very well. The quail has his whistle, the woodpecker his drum, the pewee his plaintive cry, the chickadee his exquisitely sweet call, the highhole his long, repeated “wick, wick, wick,” one of the most welcome sounds of spring, the jay his musical gurgle, the hawk his scream, the crow his sturdy caw. Only one of our pretty birds of the orchard is reduced to an all but inaudible note, and that is the cedar-bird.

III

NATURE WITH CLOSED DOORS

DECEMBER in our climate is the month when Nature finally shuts up house and turns the key. She has been slowly packing up and putting away her things and closing a door and a window here and there all the fall. Now she completes the work and puts up the last bar. She is ready for winter. The leaves are all off the trees, except that here and there a beech or an oak or a hickory still clings to a remnant of its withered foliage. Her streams are full, her new growths of wood are ripened, her saps and juices are quiescent. The muskrat has completed his house in the shallow pond or stream, the beaver in the northern woods has completed his. The wild mice and the chipmunk have laid up their winter stores of nuts and grains in their dens in the ground and in the cavities of trees. The woodchuck is rolled up in his burrow in the hillside, sleeping his long winter sleep. The coon has deserted his chamber in the old tree and gone into winter quarters in his den in the rocks. The winter birds have taken on a good coat of fat against the coming cold and a possible scarcity of food. The

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frogs and toads are all in their hibernaculums in the ground.

I saw it stated the other day, in a paper read before some scientific body, that the wood frogs retreat two feet into the ground beyond the reach of frost. In two instances I have found the wood frog in December with a covering of less than two inches of leaves and moss. It had buried itself in the soil and leaf mould only to the depth of the thickness of its own body, and for covering had only the ordinary coat of dry leaves and pine needles to be found in the wood. It was evidently counting upon the snow for its main protection. In one case I marked the spot, and returned there in early spring to see how the frog had wintered. I found it all right. Evidently it had some charm against the cold, for while the earth around and beneath it was yet frozen solid, there was no frost in the frog. It was not a brisk frog, but it was well, and when I came again on a warm day a week later, it had come forth from its retreat and was headed for the near-by marsh, where in April, with its kith and kin, it helped make the air vocal with its love-calls. A friend of mine, one mild day late in December, found a wood frog sitting upon the snow in the woods. She took it home and put it to bed in the soil of one of her flower-pots in the cellar. In the spring she found it in good condition, and in April carried it back to the woods. The hyla, or little piping frog, passes the winter in the ground like

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the wood frog. I have seen the toad go into the ground in the late fall. It is an interesting proceeding. It literally elbows its way into the soil. It sits on end, and works and presses with the sharp joints of its folded legs until it has sunk itself at a sufficient depth, which is only a few inches beneath the surface. The water frogs appear to pass the winter in the mud at the bottom of ponds and marshes. The queen bumblebee and the queen hornet, I think, seek out their winter quarters in holes in the ground in September, while the drones and the workers perish. The honey-bees do not hibernate: they must have food all winter; but our native wild bees are dormant during the cold months, and survive the winter only in the person of the queen mother. In the spring these queens set up house-keeping alone, and found new families.

Insects in all stages of their growth are creatures of the warmth; the heat is the motive power that makes them go; when this fails, they are still. The katydids rasp away in the fall as long as there is warmth enough to keep them going; as the heat fails, they fail, till from the emphatic "Katy did it" of August they dwindle to a hoarse, dying, "Kate, Kate," in October. Think of the stillness that falls upon the myriad wood-borers in the dry trees and stumps in the forest as the chill of autumn comes on. All summer have they worked incessantly in oak and hickory and birch and chestnut and spruce,

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some of them making a sound exactly like that of the old-fashioned hand augur, others a fine, snapping, and splintering sound; but as the cold comes on, they go slower and slower, till they finally cease to move. A warm day starts them again, slowly or briskly according to the degree of heat, but in December they are finally stilled for the season. These creatures, like the big fat grubs of the June beetles which one sometimes finds in the ground or in decayed wood, are full of frost in winter; cut one of the big grubs in two, and it looks like a lump of ice cream.

Some time in October the crows begin to collect together in large flocks and establish their winter quarters. They choose some secluded wood for a roosting-place, and thither all the crows for many square miles of country betake themselves at night, and thence they disperse in all directions again in the early morning. The crow is a social bird, a true American; no hermit or recluse is he. The winter probably brings them together in these large colonies for purposes of sociability and for greater warmth. By roosting close together and quite filling a tree-top, there must result some economy of heat.

I have seen it stated in a rhetorical flight of some writer that the new buds crowd the old leaves off. But this is not true as a rule. The new bud is formed in the axil of the old leaf long before the leaves are ready to fall. With only two species of our trees

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known to me might the swelling bud push off the old leaf. In the sumach and button-ball or plane-tree the new bud is formed immediately under the base of the old leaf-stalk, by which it is covered like a cap. Examine the fallen leaves of these trees, and you will see the cavity in the base of each where the new bud was cradled. Why the beech, the oak, and the hickory cling to their old leaves is not clear. It may be simply a slovenly trait — inability to finish and have done with a thing — a fault of so many people. Some oaks and beeches appear to lack decision of character. It requires strength and vitality, it seems, simply to let go. Kill a tree suddenly, and the leaves wither upon the branches. How neatly and thoroughly the maples, the ashes, the birches, the elm clean up. They are tidy, energetic trees, and can turn over a new leaf without hesitation.

A correspondent, writing to me from one of the colleges, suggests that our spring really begins in December, because the “annual cycle of vegetable life” seems to start then. At this time he finds that many of our wild flowers — the bloodroot, hepatica, columbine, shinleaf, maidenhair fern, etc. — have all made quite a start toward the next season’s growth, in some cases the new shoot being an inch high. But the real start of the next season’s vegetable life in this sense is long before December. It is in late summer, when the new buds are formed on the trees. Nature looks ahead, and makes ready

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for the new season in the midst of the old. Cut open the terminal hickory buds in the late fall and you will find the new growth of the coming season all snugly packed away there, many times folded up and wrapped about by protecting scales. The catkins of the birches, alders, and hazel are fully formed, and as in the case of the buds, are like eggs to be hatched by the warmth of spring. The present season is always the mother of the next, and the inception takes place long before the sun loses his power. The eggs that hold the coming crop of insect life are mostly laid in the late summer or early fall, and an analogous start is made in the vegetable world. The egg, the seed, the bud, are all alike in many ways, and look to the future. Our earliest spring flower, the skunk-cabbage, may be found with its round green spear-point an inch or two above the mould in December. It is ready to welcome and make the most of the first fitful March warmth. Look at the elms, too, and see how they swarm with buds. In early April they suggest a swarm of bees.

In all cases, before Nature closes her house in the fall, she makes ready for its spring opening.

IV

THE WIT OF A DUCK

THE homing instinct in birds and animals is one of their most remarkable traits: their strong local attachments and their skill in finding their way back when removed to a distance. It seems at times as if they possessed some extra sense — the home sense — which operates unerringly. I saw this illustrated one spring in the case of a mallard drake.

My son had two ducks, and to mate with them he procured a drake of a neighbor who lived two miles south of us. He brought the drake home in a bag. The bird had no opportunity to see the road along which it was carried, or to get the general direction, except at the time of starting, when the boy carried him a few rods openly.

He was placed with the ducks in a spring run, under a tree in a secluded place on the river slope, about a hundred yards from the highway. The two ducks treated him very contemptuously. It was easy to see that the drake was homesick from the first hour, and he soon left the presence of the scornful ducks.

Then we shut the three in the barn together,

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and kept them there a day and a night. Still the friendship did not ripen; the ducks and the drake separated the moment we let them out. Left to himself, the drake at once turned his head homeward, and started up the Lill for the highway.

Then we shut the trio up together again for a couple of days, but with the same results as before. There seemed to be but one thought in the mind of the drake, and that was home.

Several times we headed him off and brought him back, till finally on the third or fourth day I said to my son, "If that drake is really bound to go home, he shall have an opportunity to make the trial, and I will go with him to see that he has fair play." We withdrew, and the homesick mallard started up through the currant patch, then through the vineyard toward the highway which he had never seen.

When he reached the fence, he followed it south till he came to the open gate, where he took to the road as confidently as if he knew for a certainty that it would lead him straight to his mate. How eagerly he paddled along, glancing right and left, and increasing his speed at every step! I kept about fifty yards behind him. Presently he met a dog; he paused and eyed the animal for a moment, and then turned to the right along a road which diverged just at that point, and which led to the railroad station. I followed, thinking the drake would soon

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lose his bearings, and get hopelessly confused in the tangle of roads that converged at the station.

But he seemed to have an exact map of the country in his mind; he soon left the station road, went around a house, through a vineyard, till he struck a stone fence that crossed his course at right angles; this he followed eastward till it was joined by a barbed wire fence, under which he passed and again entered the highway he had first taken. Then down the road he paddled with renewed confidence: under the trees, down a hill, through a grove, over a bridge, up the hill again toward home.

Presently he found his clue cut in two by the railroad track; this was something he had never before seen; he paused, glanced up it, then down it, then at the highway across it, and quickly concluded this last was his course. On he went again, faster and faster.

He had now gone half the distance, and was getting tired. A little pool of water by the roadside caught his eye. Into it he plunged, bathed, drank, preened his plumage for a few moments, and then started homeward again. He knew his home was on the upper side of the road, for he kept his eye bent in that direction, scanning the fields. Twice he stopped, stretched himself up, and scanned the landscape intently; then on again. It seemed as if an invisible cord was attached to him, and he was being pulled down the road.

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Just opposite a farm lane which led up to a group of farm buildings, and which did indeed look like his home lane, he paused and seemed to be debating with himself. Two women just then came along; they lifted and flirted their skirts, for it was raining, and this disturbed him again and decided him to take to the farm lane. Up the lane he went, rather doubtfully, I thought.

In a few moments it brought him into a barnyard, where a group of hens caught his eye. Evidently he was on good terms with hens at home, for he made up to these eagerly as if to tell them his troubles; but the hens knew not ducks; they withdrew suspiciously, then assumed a threatening attitude, till one old "dominic" put up her feathers and charged upon him viciously.

Again he tried to make up to them, quacking softly, and again he was repulsed. Then the cattle in the yard spied this strange creature and came sniffing toward it, full of curiosity.

The drake quickly concluded he had got into the wrong place, and turned his face southward again. Through the fence he went into a plowed field. Presently another stone fence crossed his path; along this he again turned toward the highway. In a few minutes he found himself in a corner formed by the meeting of two stone fences. Then he turned appealingly to me, uttering the soft note of the mallard. To use his wings never seemed to cross his mind.

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Well, I am bound to confess that I helped the drake over the wall, but I sat him down in the road as impartially as I could. How well his pink feet knew the course! How they flew up the road! His green head and white throat fairly twinkled under the long avenue of oaks and chestnuts.

At last we came in sight of the home lane, which led up to the farmhouse one hundred or more yards from the road. I was curious to see if he would recognize the place. At the gate leading into the lane he paused. He had just gone up a lane that looked like that and had been disappointed. What should he do now? Truth compels me to say that he overshot the mark: he kept on hesitatingly along the highway.

It was now nearly night. I felt sure the duck would soon discover his mistake, but I had not time to watch the experiment further. I went around the drake and turned him back. As he neared the lane this time he seemed suddenly to see some familiar landmark, and he rushed up it at the top of his speed. His joy and eagerness were almost pathetic.

I followed close. Into the house yard he rushed with uplifted wings, and fell down almost exhausted by the side of his mate. A half hour later the two were nipping the grass together in the pasture, and he, I have no doubt, was eagerly telling her the story of his adventures.

V

FACTORS IN ANIMAL LIFE

THE question that the Californian schoolchildren put to me, "Have the birds got sense?" still "sticks in my crop."

Such extraordinary sense has been attributed to most of the wild creatures by several of our latter day nature-writers, that I have been moved to examine the whole question more thoroughly than ever before, and to find out, as far as I can, just how much and what kind of sense the birds and four-footed beasts have.

In this and in some following chapters I shall make an effort to use my own sense to the best advantage in probing that of the animals, which has, as I think, been so vastly overrated.

When sentiment gets overripe, it becomes sentimentalism. The sentiment for nature which has been so assiduously cultivated in our times is fast undergoing this change, and is softening into sentimentalism toward the lower animals. Many a wholesome feeling can be pushed so far that it becomes a weakness and a sign of disease. Pity for the sufferings of our brute neighbors may be a manly

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feeling; and then again it may be so fostered and cosseted that it becomes maudlin and unworthy. When hospitals are founded for sick or homeless cats and dogs, when all forms of vivisection are cried down, when the animals are humanized and books are written to show that the wild creatures have schools and kindergartens, and that their young are instructed and disciplined in quite the human way by their fond parents; when we want to believe that reason and not instinct guides them, that they are quite up in some of the simpler arts of surgery, mending or amputating their own broken limbs and salving their wounds, — when, I say, our attitude toward the natural life about us and our feeling for it have reached the stage implied by these things, then has sentiment degenerated into sentimentalism, and our appreciation of nature lost its firm edge.

No doubt there is a considerable number of people in any community that are greatly taken with this improved anthropomorphic view of wild nature now current among us. Such a view tickles the fancy and touches the emotions. It makes the wild creatures so much more interesting. Shall we deny anything to a bird or beast that makes it more interesting, and more worthy of our study and admiration?

This sentimental view of animal life has its good side and its bad side. Its good side is its result in

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making us more considerate and merciful toward our brute neighbors ; its bad side is seen in the degree to which it leads to a false interpretation of their lives. The tendency to which I refer is no doubt partly the result of our growing humanitarianism and feeling of kinship with all the lower orders of creation, and partly due to the fact that we live in a time of impromptu nature study, when birds and plants and trees are fast becoming a fad with half the population, and when the "yellow" reporter is abroad in the fields and woods. Never before in my time have so many exaggerations and misconceptions of the wild life about us been current in the popular mind. It is becoming the fashion to ascribe to the lower animals nearly all our human motives and attributes, and often to credit them with plans and devices that imply reason and a fair amount of mechanical knowledge. An illustration of this is the account of the nest of a pair of orioles, as described in the "North American Review" for May, 1903, by a writer of popular nature books. These orioles built a nest so extraordinary that it can be accounted for only on the theory that there *is* a school of the woods, and that these two birds had been pupils there and had taken an advanced course in Strings. Among other things impossible for birds to do, these orioles tied a knot in the end of a string to prevent its fraying in the wind ! If the whole idea were not too preposterous for even a half-witted child to believe, one

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might ask, What in the name of anything and everything but the "Modern School of Nature Study" do orioles know about strings fraying in the wind and the use of knots to prevent it? They have never had occasion to know; they have had no experience with strings that hang loose and unravel in the wind. They often use strings, to be sure, in building their nests, but they use them in a sort of haphazard way, weaving them awkwardly into the structure, and leaving no loose ends that would suffer by fraying in the wind. Sometimes they use strings in attaching the nest to the limb, but they never knot or tie them; they simply wind them round and round as a child might. It is possible that a bird might be taught to tie a knot with its foot and beak, though I should have to see it done to be convinced. But the orioles in question not only tied knots; they tied them with a "reversed double hitch, the kind that a man uses in cinching his saddle"! More wonderful still, not finding in a New England elm-embowered town a suitable branch from which to suspend their nest, the birds went down upon the ground and tied three twigs together in the form of "a perfectly measured triangle" (no doubt working from a plan drawn to a scale). They attached to the three sides of this framework four strings of equal length (eight or ten inches), all carefully doubled, tied them to a heavier string, carried the whole ingenious contrivance to a tree, and tied it fast to a limb in precisely the way you

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or I would have done it! From this framework they suspended their nest, the whole structure being about two feet long, and having the effect of a small hanging basket. Still more astonishing, when the genuineness of the nest is questioned, a man is found who makes affidavit that he saw the orioles build it! After such a proceeding, how long will it be before the water-birds are building little rush cradles for their young, or rush boats to be driven about the ponds and lakes by means of leaf sails, or before Jenny Wren will be living in a log cabin of her own construction? How long will it be before some one makes affidavit that the sparrow with his bow and arrow has actually been seen to kill Cock Robin, and the beetle with his thread and needle engaged in making the shroud? Birds show the taste and skill of their kind in building their nests, but rarely any individual ingenuity and inventiveness. The nest referred to is on a plane entirely outside of Nature and her processes. It belongs to a different order of things, the order of mechanical contrivances, and was of course "made up," probably from a real oriole's nest, and the writer who vouches for its genuineness has been the victim of a clever practical joke — a willing victim, no doubt, since he is looking in Nature for just this kind of thing, and since he believes there is "absolutely no limit to the variety and adaptiveness of Nature even in a single species." If there is no such limit, then I suppose

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we need not be surprised to meet a winged horse, or a centaur, or a mermaid at any time.

It is as plain as anything can be that the animals share our emotional nature in vastly greater measure than they do our intellectual or our moral nature; and because they do this, because they show fear, love, joy, anger, sympathy, jealousy, because they suffer and are glad, because they form friendships and local attachments and have the home and paternal instincts, in short, because their lives run parallel to our own in so many particulars, we come, if we are not careful, to ascribe to them the whole human psychology. But it is equally plain that of what we mean by mind, intellect, they show only a trace now and then. They do not accumulate a store of knowledge any more than they do a store of riches. A store of knowledge is impossible without language. Man began to emerge from the lower orders when he invented a language of some sort. As the language of animals is little more than various cries expressive of pleasure or pain, or fear or suspicion, they do not think in any proper sense, because they have no terms in which to think — no language. I shall have more to say upon this point in another chapter. One trait they do show which is the first step toward knowledge — curiosity. Nearly all the animals show at times varying degrees of curiosity, but here again an instinctive feeling of possible danger probably lies back of it. They even

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seem to show at times a kind of altruistic feeling. A correspondent writes me that she possessed a canary which lived to so great an age that it finally became so feeble it could not crack the seeds she gave it, when the other birds, its own progeny, it is true, fed it; and Darwin cites cases of blind birds, in a state of nature, being fed by their fellows. Probably it would be hasty to conclude that such acts show anything more than instinct. I should be slow to ascribe to the animals any notion of the uses of punishment as we practice it, though the cat will box her kittens when they play too long with her tail, and the mother hen will separate her chickens when they get into a fight, and sometimes peck one or both of them on the head, as much as to say, "There, don't you do that again." The rooster will in the same way separate two hens when they are fighting. On the surface this seems like a very human act, but can we say that it is punishment or discipline in the human sense, as having for its aim a betterment of the manners of the kittens or of the chickens? The cat aims to get rid of an annoyance, and the rooster and the mother hen interfere to prevent an injury to members of their family; they exhibit the paternal and maternal instinct of protection. More than that would imply ethical considerations, of which the lower animals are not capable. The act of the baboon, mentioned by Darwin, I believe, that examined the paws of the cat that had scratched it, and then deliberately bit off

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the nails, belongs to a different and to a higher order of conduct.

A complete statement of the factors that shape the lives of the lower orders would include three terms — instinct, imitation (though, doubtless, this is instinctive), and experience. Instinct is, of course, the main factor, and by this term we mean that which prompts an animal or a man to act spontaneously, without instruction or experience. All creatures are imitative, and man himself not the least so. I had a visit the other day from a woman who had spent the last two years in London, and her speech betrayed the fact; she had quite unconsciously caught certain of the English mannerisms of speech. A few years in the South will give the New Englander the Southern accent, and vice versa. The young are, of course, more imitative than the old. Children imitate their parents; the young writer imitates his favorite author.

Animals of different species closely associated will imitate each other. A lady writes me that she has a rabbit that lives in a cage with a monkey, and that it has caught many of the monkey's ways. I can well believe it. Dogs reared with cats have been known to acquire the cat habit of licking the paws and then washing the ears and face. Wolves reared with dogs learn to bark, and who has not seen a dog draw its face as if trying to laugh as its master does? When a cat has been taught to sit up for its food,

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its kittens have been known to imitate the mother. Darwin tells of a cat that used to put its paw into the mouth of a narrow milk-jug and then lick it off, and that its kittens soon learned the same trick. In all such cases, hasty observers say the mother taught its young. Certainly the young learned, but there was no effort to teach on the part of the parent. Unconscious imitation did it all. Our "Modern School of Nature Study" would say that the old sow teaches her pigs to root when they follow her afield, rooting in their little ways as she does. But would she not root if she had no pigs, and would not the pigs root if they had no mother? All acts necessary to an animal's life and to the continuance of the species are instinctive; the creature does not have to be taught them, nor are they acquired by imitation. The bird does not have to be taught to build its nest or to fly, nor the beaver to build its dam or its house, nor the otter or the seal to swim, nor the young of mammals to suckle, nor the spider to spin its web, nor the grub to weave its cocoon. Nature does not trust these things to chance; they are too vital. The things that an animal acquires by imitation are of secondary importance in its life. As soon as the calf, or the lamb, or the colt can get upon its feet, its first impulse is to find the udder of its dam. It requires no instruction or experience to take this important step.

How far the different species of song-birds acquire each their peculiar songs by imitation is a question

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that has not yet been fully settled. That imitation has much to do with it admits of little doubt. The song of a bird is of secondary importance in its life. Birds reared in captivity, where they have never heard the songs of their kind, sing at the proper age, but not always the songs of their parents. Mr. Scott of Princeton proved this with his orioles. They sang at the proper age, but not the regular oriole song. I am told that there is a well-authenticated case of an English sparrow brought up with canaries that learned to sing like a canary. "The Hon. Daines Barrington placed three young linnets with three different foster-parents, the skylark, the woodlark, and the titlark or meadow-pipit, and each adopted, through imitation, the song of its foster-parent." I have myself heard goldfinches that were reared in a cage sing beautifully, but not the regular goldfinch song; it was clearly the song of a finch, but of what finch I could not have told. I have also heard a robin that sang to perfection the song of the brown thrasher; it had, no doubt, caught it by imitation. I have heard another robin that had the call of the quail interpolated into its own proper robin's song. But I have yet to hear of a robin building a nest like a brown thrasher, or of an oriole building a nest like a robin, or of kingfishers drilling for grubs in a tree. The hen cannot keep out of the water the ducks she has hatched, nor can the duck coax into the water the chickens she has hatched. The cowbird hatched

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and reared by the sparrow, or the warbler, or the vireo does not sing the song of the foster-parent. Why? Did its parent not try to teach it? I have no evidence that young birds sing, except occasionally in a low, tentative kind of way, till they return the following season, and then birds of a feather flock together, robins staying with robins, and cowbirds with cowbirds, each singing the song of its species. The songs of bobolinks differ in different localities, but those of the same locality always sing alike. I once had a caged skylark that imitated the songs of nearly every bird in my neighborhood.

Mr. Leander S. Keyser, author of "Birds of the Rockies," relates in "Forest and Stream" the results of his experiments with a variety of birds taken from the nest while very young and reared in captivity; among them meadowlarks, red-winged blackbirds, brown thrashers, blue jays, wood thrushes, catbirds, flickers, woodpeckers, and several others. Did they receive any parental instruction? Not a bit of it, and yet at the proper age they flew, perched, called, and sang like their wild fellows — all except the robins and the red-winged blackbirds: these did not sing the songs of their species, but sang a medley made up of curious imitations of human and other sounds. And the blue jay never learned to sing "the sweet gurgling roulade of the wild jays," though it gave the blue jay call correctly. Mr. Keyser's experiment was interesting and valuable.

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but his sagacity fails him when interpreting the action of the jay in roosting in an exposed place after it had been given its liberty. He thinks this showed how little instinct can be relied on, and how much the bird needed parental instruction. Could he not see that the artificial life of the bird in the cage had demoralized its instincts, and that acquired habits had supplanted native tendencies? The bird had learned to be unafraid in the cage, and why should it be afraid out of the cage? This reminds me of a letter from a correspondent: he had a tame crow that was not afraid of a gun; therefore he concluded that the old crows must instill the fear of guns into their young! Why should the crow be afraid of a gun, if it had learned not to be afraid of the gunner?

I have seen a young chickadee fly late in the day from the nest in the cavity of a tree straight to a pear-tree, where it perched close to the trunk and remained unregarded by its parents till next morning. But no doubt its parents had given it minute directions before it left the nest how to fly and where to perch!

That animals learn by experience in a limited way is very certain. Yet that old birds build better nests or sing better than young ones it would be hard to prove, though it seems reasonable that it should be so.

Rarely does one see nests of the same species of

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varying degrees of excellence — that is, first nests in the spring. The second nest of any species is likely to be a more hurried and incomplete affair. Some species are at all times poor nest-builders, as the cuckoos and the pigeons. Other birds are good nest-builders, as the orioles, the thrushes, the finches, the warblers, the hummingbirds, and one never finds an inferior specimen of the nests of any of these birds. There is probably no more improvement in this respect among birds than there is among insects.

I have no proof that wild birds improve in singing. One does not hear a vireo, or a finch, or a thrush, or a warbler that is noticeably inferior as a songster to its fellows; their songs are all alike, except in the few rare cases when one hears a master songster among its kind; but whether this mastery is natural or acquired, who shall tell?

What birds learn about migration, if anything. I do not see that we have any means of finding out.

It has been observed of birds reared under artificial conditions that the young males practice a long time before they sing well. That this is true of wild birds, there is no proof. What birds and animals learn by experience is greater cunning. Does not even an old trout know more about hooks than a young one? Birds of any kind that are much hunted become wilder, even though they have not had the experience of being shot. Ask any duck or grouse or quail hunter if this is not so. Our ruffed grouse learns to

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fly with a corkscrew motion where it is much fired at on the wing. How wary and cautious the fox becomes in regions where it is much trapped and hunted! Even the woodchuck becomes very wild on the farms where it is much shot at, and this wildness extends to its young. In his "Wilderness Hunter" President Roosevelt says the same thing of the big game of the Rockies. Antelope and deer can be lured near the concealed hunter by the waving of a small flag till they are shot at a few times. Then they see through the trick. "The burnt child fears the fire." Animals profit by experience in this way; they learn what not to do. In the accumulation of positive knowledge, so far as we know, they make little or no progress. Birds and beasts will adapt themselves more or less to their environment, but plants and trees will do that, too. The rats in Jamaica have learned to nest in trees to escape the mongoose, but this is only the triumph of the instinct of self-preservation. The mongoose has not yet learned to climb trees; the pressure of need is not yet great enough. It is said that in districts subject to floods moor-hens often build in trees. All animals will change their habits under pressure of necessity; man changes his without this pressure. The Duke of Argyll saw a bald eagle seize a fish in the stream — an unusual proceeding; but the eagle was doubtless very hungry, and there was no osprey near upon whom to levy tribute.

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Romanes found that rats would get certain semi-liquid foods out of a bottle with their tails, as a cat will get milk out of a jar with her paw, but neither ever progresses so far as to use any sort of tool for the purpose, or to tip the vessel over. Animals practice concealment to secure their prey, but not deception, as man does. They do not use lures or disguises, or traps or poison.

There is, of course, no limit to the variety and adaptiveness of nature taken as a whole, but each species is hedged about by impassable limitations. The ouzel is akin to the thrushes, and yet it lives along and in the water. Does it ever take to the fields and woods, and live on fruit and land-insects, and nest in trees like other thrushes? So with all birds and beasts. They vary constantly, but not in one lifetime, and the sum of these variations, accumulated through natural selection, as Darwin has shown, gives rise, in the course of long periods of time, to new species.

As I have already said, domestic animals vary more than wild ones. Every farmer and poultry-grower knows that some hens are better with chickens than others — more motherly, more careful — and rear a greater number of their brood. The same is true of sows with pigs. Some sows will eat their pigs, and wild animals in cages often destroy their young. Some ewes will not own their lambs, and occasionally a cow will not own her calf. (Such cases

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show perverted or demoralized instinct.) Similar to these are the strange friendships that sometimes occur among the domestic animals, as that of a sheep with a cow, a goose with a horse, or a hen adopting kittens. In a state of nature these curious attachments probably never spring up. Instinct is likely to be more or less demoralized when animal life touches human life.

With the wild creatures we sometimes see one instinct overcoming another, as when fear drives a bird to desert its nest, or when the instinct of migration leads a pair of swallows to desert their unfledged young.

A great many young birds come to grief by leaving the nest before they can fly. In such cases, I suppose, they disobey the parental instructions! I find it easier to believe that instinct is at fault, or that one instinct has overcome another; something has disturbed or alarmed the young birds, and the fear of danger has led them to attempt flight before their wings were strong enough. Once, when I was climbing up to the nest of a broad-winged hawk, the young took fright and launched out in the air, coming to the ground only a few rods away.

Instinct, natural prompting, is the main matter, after all. It makes up at least nine tenths of the lives of all our wild neighbors. How much has fear had to do in shaping their lives and in perpetuating them! And "fear of any particular enemy," says

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Darwin, "is certainly an instinctive quality." It has been said that kittens confined in a box, and which have never known a dog, will spit and put up their backs at a hand that has just stroked a dog, — even before their eyes are opened, one authority says, but this I doubt. My son's tame gray squirrel had never seen chestnuts, nor learned about them in the school of the woods, and yet when he was offered some, he fairly danced with excitement; he put his paws eagerly around them and drew them to him, and chattered, and looked threateningly at all about him. Does man know his proper food in the same way? The child has only the instinct to eat, and will put anything into its mouth.

How the instinctive wildness of the turkey crops out in the young! Let the mother turkey while hovering her brood give the danger-signal, and the young will run from under her and hide in the grass. Why? To give her a chance to fly and decoy away the enemy. I think young chickens will do the same. Young partridges hatched under a hen run away at once. Pheasants in England reared under a domestic fowl are as wild as in a state of nature. Some California quail hatched under a bantam hen in the Zoo in New York did not heed the calls of their foster-mother at all the first week, but at her alarm-note they instantly squatted, showing that the danger-cry of a fowl is a kind of universal language that all species understand. One may prove this at any

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time by arousing the fears of any wild bird: how all the other birds catch the alarm! Charles St. John says that in Scotland the stag you are stalking is sure to be put to flight if it hears the alarm-cry of the cock-grouse. You see it is more important that the wild creatures should understand the danger-signals of one another than that they should understand the rest of their language.

To what extent animals reason, or show any glimmering of what we call reason, is a much-debated question among animal psychologists, and I shall have more to say upon the subject later on. Dogs undoubtedly show gleams of reason, and other animals in domestication, such as the elephant and the monkey. One does not often feel like questioning Darwin's conclusions, yet the incident of the caged bear which he quotes, that pawed the water in front of its cage to create a current that should float within its reach a piece of bread that had been placed there, does not, in my judgment, show any reasoning about the laws of hydrostatics. The bear would doubtless have pawed a cloth in the same way, vaguely seeking to draw the bread within reach. But when an elephant blows through his trunk upon the ground *beyond* an object which he wants, but which is beyond his reach, so that the rebounding air will drive it toward him, he shows something very much like reason.

Instinct is a kind of natural reason, — reason

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that acts without proof or experience. The principle of life in organic nature seeks in all ways to express and to perpetuate itself. It finds many degrees of expression and fulfillment in the vegetable world; it finds higher degrees of expression and fulfillment in the animal world, reaching its highest development in man.

That the animals, except those that have been long associated with man, and they only in occasional gleams and hints, are capable of any of our complex mental processes, that they are capable of an act of reflection, of connecting cause and effect, of putting this and that together, is to me void of proof. Why, there are yet savage tribes in which the woman is regarded as the sole parent of the child. When the mother is sick at childbirth, the father takes to his bed and feigns the illness he does not feel, in order to establish his relationship to the child. It is not at all probable that the males of any species of animals, or the females either, are guided or influenced in their actions by the desire for offspring, or that they possess anything like knowledge of the connection between their love-making and their offspring. This knowledge comes of reflection, and reflection the lower animals are not capable of. But I shall have more to say upon this point in another chapter, entitled "What do Animals Know?" I will only say here that animals are almost as much under the dominion of absolute nature, or what we

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call instinct, innate tendency, habit of growth, as are the plants and trees. Their lives revolve around three wants or needs — the want of food, of safety, and of offspring. It is in securing these ends that all their wit is developed. They have no wants outside of these spheres, as man has. Their social wants and their love of beauty, as in some of the birds, are secondary. It is quite certain that the animals that store up food for the winter do not take any thought of the future. Nature takes thought for them and gives them their provident instinct. The jay, by his propensity to carry away and hide things, plants many of our oak and chestnut trees, but who dares say that he does this on purpose, any more than that the insects cross-fertilize the flowers on purpose? Sheep do not take thought of the wool upon their backs that is to protect them from the cold of winter, nor does the fox of his fur. In the tropics sheep cease to grow wool in three or four years.

All the lower animals, so far as I know, swim the first time they find themselves in the water. They do not have to be taught: it is a matter of instinct. It is what we should expect from our knowledge of their lives. Not so with man; he must learn to swim as he learns so many other things. The stimulus of the water does not at once set in motion his legs and arms in the right way, as it does the animal's legs; his powers of reason and reflection paralyze him — his brain carries him down

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Not until he has learned to resign himself to the water as the animal does, and to go on all fours, can he swim. As soon as the boy ceases to struggle against his tendency to sink, assumes the horizontal position, and strikes out as the animal does, with but one thought, and that to apply his powers of locomotion to the medium about him, he swims as a matter of course. It is said that children have sometimes been known to swim when thrown into the water. Their animal instincts were not thwarted by their powers of reflection. Doubtless this never happened to a grown person. Moreover, is it not probable that the specific gravity of the hairless human body is greater than that of the hair-covered animal, and that it sinks, while that of the cat or dog floats? This, with the erect position of man, makes swimming with him an art that must be acquired.

There is no better illustration of the action of instinct as opposed to conscious intelligence than is afforded by the parasitic birds, — the cuckoo in Europe and the cowbird in this country, — birds that lay their eggs in the nests of other birds. Darwin speculates as to how this instinct came about, but whatever may have been its genesis, it is now a fixed habit among these birds. Moreover, the instinct of the blind young alien, a day or two after it is hatched, to throw or crowd its foster-brothers out of the nest is a strange and anomalous act, and is as untaught and unreasoned as anything in vegetable life. But

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when our yellow warbler, finding this strange egg of the cowbird in her nest, proceeds to bury it by putting another bottom in the nest and carrying up the sides to correspond, she shows something very much like sense and judgment, though of a clumsy kind. How much simpler and easier it would be to throw out the strange egg! I have known the cowbird herself to carry an egg from a nest in which she wished to deposit one of her own. Again, how stupid and ludicrous it seems on the part of the mother sparrow, or warbler, or vireo, when she goes about toiling desperately to satisfy the hunger of her big clamorous bantling of a cowbird, never suspecting that she has been imposed upon!

Of course the line that divides man from the lower orders is not a straight line. It has many breaks and curves and deep indentations. The man-like apes, as it were, mark where the line rises up into the domain of man. Furthermore, the elephant and the dog, especially as we know them in domestication, encroach upon man's territory.

Men are born with aptitudes for different things, but the art and the science of them all they have to learn; proficiency comes with practice. Man must learn to spin his web, to build his house, to sing his song, to know his food, to sail his craft, to find his way — things that the animals know "from the jump." The animal inherits its knowledge and its skill: man must acquire his by individual effort; all he inherits

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is capacity in varying degrees for these things. The animal does rational things without an exercise of reason. It is intelligent as nature is intelligent. It does not know that it knows, or how it knows, while man does. Man's knowledge is the light of his mind that shines on many and widely different objects, while the knowledge of animals cannot be symbolized by the term "light" at all. The animal acts blindly so far as any conscious individual illumination or act of judgment is concerned. It does the thing unwittingly, because it must. Confront it with a new condition, and it has no resources to meet that condition. The animal knows what necessity taught its progenitors, and it knows that only as a spontaneous impulse to do certain things.

Instinct, I say, is a great matter, and often shames reason. It adapts means to an end, it makes few or no mistakes, it takes note of times and seasons, it delves, it bores, it spins, it weaves, it sews, it builds, it makes paper, it constructs a shelter, it navigates the air and the water, it is provident and thrifty, it knows its enemies, it outwits its foes, it crosses oceans and continents without compass, it foreshadows nearly all the arts and trades and occupations of mankind, it is skilled without practice, and wise without experience. How it arose, what its genesis was, who can tell? Probably natural selection has been the chief agent in its development. If natural selection has developed and sharpened the claws of

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the cat and the scent of the fox, why should it not develop and sharpen their wits also? The remote ancestors of the fox or of the crow were doubtless less shrewd and cunning than the crows and the foxes of to-day. The instinctive intelligence of an animal of our time is the sum of the variations toward greater intelligence of all its ancestors. What man stores in language and in books — the accumulated results of experience — the animals seem to have stored in instinct. As Darwin says, a man cannot, on his first trial, make a stone hatchet or a canoe through his power of imitation. "He has to learn his work by practice; a beaver, on the other hand, can make its dam or canal, and a bird its nest, as well or nearly as well, and a spider its wonderful web quite as well, the first time it tries as when old and experienced."

An animal shows intelligence, as distinct from instinct, when it takes advantage of any circumstance that arises at the moment, when it finds new ways, whether better or not, as when certain birds desert their old nesting-sites, and take up with new ones afforded by man. This act, at least, shows power of choice. The birds and beasts all quickly avail themselves of any new source of food supply. Their wits are probably more keen and active here than in any other direction. It is said that in Oklahoma the coyotes have learned to tell ripe water-melons from unripe ones by scratching upon them.

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If they have not, they probably will. Eating is the one thing that engrosses the attention of all creatures, and the procuring of food has been a great means of education to all.

I notice that certain of the wood-folk — mice and squirrels and birds — eat mushrooms. If I would eat them, I must learn how to distinguish the edible from the poisonous ones. I have no special sense to guide me in the matter, as doubtless the squirrels have. Their instinct is sure where my reason fails. It would be very interesting to know if they ever make a mistake in this matter. Domestic animals sometimes make mistakes as to their food because their instinct has been tampered with and is by no means as sure as that of the wild creatures. It is said that sheep will occasionally eat laurel and St. John's-wort, which are poisonous to them. In the far West I was told that the horses sometimes eat a weed called the loco-weed that makes them crazy. I have since learned that the buffaloes and cattle with a strain of the buffalo blood never eat this weed.

The imitation among the lower animals to which I have referred is in no sense akin to teaching. The boy does not learn arithmetic by imitation. To teach is to bring one mind to act upon another mind; it is the result of a conscious effort on the part of both teacher and pupil. The child, says Darwin, has an instinctive tendency to speak, but not to brew, or bake, or write. The child comes to speak by imita-

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tion, as does the parrot, and then learns the meaning of words, as the parrot does not.

I am convinced there is nothing in the notion that animals consciously teach their young. Is it probable that a mere animal reflects upon the future any more than it does upon the past? Is it solicitous about the future well-being of its offspring any more than it is curious about its ancestry? Persons who think they see the lower animals training their young consciously or unconsciously supply something to their observations; they read their own thoughts or preconceptions into what they see. Yet so trained a naturalist and experienced a hunter as President Roosevelt differs with me in this matter. In a letter which I am permitted to quote, he says: —

“I have not the slightest doubt that there is a large amount of *unconscious* teaching by wood-folk of their offspring. In unfrequented places I have had the deer watch me with almost as much indifference as they do now in the Yellowstone Park. In frequented places, where they are hunted, young deer and young mountain sheep, on the other hand, — and of course young wolves, bobcats, and the like, — are exceedingly wary and shy when the sight or smell of man is concerned. Undoubtedly this is due to the fact that from their earliest moments of going about they learn to imitate the unflagging watchfulness of their parents, and by the exercise of some associative or imitative quality they grow to imitate and then to

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share the alarm displayed by the older ones at the smell or presence of man. A young deer that has never seen a man feels no instinctive alarm at his presence, or at least very little; but it will undoubtedly learn to associate extreme alarm with his presence from merely accompanying its mother, if the latter feels such alarm. I should not regard this as schooling by the parent any more than I should so regard the instant flight of twenty antelope who had not seen a hunter, because the twenty-first has seen him and has instantly run. Sometimes a deer or an antelope will deliberately give an alarm-cry at sight of something strange. This cry at once puts every deer or antelope on the alert; but they will be just as much on the alert if they witness nothing but an exhibition of fright and flight on the part of the first deer or antelope, without there being any conscious effort on its part to express alarm.

“Moreover, I am inclined to think that on certain occasions, rare though they may be, there is a conscious effort at teaching. I have myself known of one setter dog which would thrash its puppy soundly if the latter carelessly or stupidly flushed a bird. Something similar may occur in the wild state among such intelligent beasts as wolves and foxes. Indeed, I have some reason to believe that with both of these animals it does occur — that is, that there is conscious as well as unconscious teaching of the young in such matters as traps.”

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Probably the President and I differ more in the meaning we attach to the same words than in anything else. In a subsequent letter he says: "I think the chief difference between you and me in the matter is one of terminology. When I speak of unconscious teaching, I really mean simply acting in a manner which arouses imitation."

Imitation is no doubt the key to the whole matter. The animals unconsciously teach their young by their example, and in no other way. But I must leave the discussion of this subject for another chapter.

VI

ANIMAL COMMUNICATION

THE notion that animals consciously train and educate their young has been held only tentatively by European writers on natural history. Darwin does not seem to have been of this opinion at all. Wallace shared it at one time in regard to the birds, — their songs and nest-building, — but abandoned it later, and fell back upon instinct or inherited habit. Some of the German writers, such as Brehm, Büchner, and the Müllers, seem to have held to the notion more decidedly. But Professor Groos had not yet opened their eyes to the significance of the play of animals. The writers mentioned undoubtedly read the instinctive play of animals as an attempt on the part of the parents to teach their young.

That the examples of the parents in many ways stimulate the imitative instincts of the young is quite certain, but that the parents in any sense aim at instruction is an idea no longer held by writers on animal psychology.

Of course it all depends upon what we mean by teaching. Do we mean the communication of know-

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ledge, or the communication of emotion? It seems to me that by teaching we mean the former. Man alone communicates knowledge; the lower animals communicate feeling or emotion. Hence their communications always refer to the present, never to the past or to the future.

That birds and beasts do communicate with each other, who can doubt? But that they impart knowledge, that they have any knowledge to impart, in the strict meaning of the word, any store of ideas or mental concepts — that is quite another matter. Teaching implies such store of ideas and power to impart them. The subconscious self rules in the animal; the conscious self rules in man, and the conscious self alone can teach or communicate knowledge. It seems to me that the cases of the deer and the antelope, referred to by President Roosevelt in the letter to me quoted in the last chapter, show the communication of emotion only.

Teaching implies reflection and judgment; it implies a thought of, and solicitude for, the future. "The young will need this knowledge," says the human parent, "and so we will impart it to them now." But the animal parent has consciously no knowledge to impart, only fear or suspicion. One may affirm almost anything of trained dogs and of dogs generally. I can well believe that the setter bitch spoken of by the President punished her pup when it flushed a bird, — she had been punished herself for the same

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offense, — but that the act was expressive of anything more than her present anger, that she was in any sense trying to train and instruct her pup, there is no proof.

But with animals that have not been to school to man, all ideas of teaching must be rudimentary indeed. How could a fox or a wolf instruct its young in such matters as traps? Only in the presence of the trap, certainly; and then the fear of the trap would be communicated to the young through natural instinct. Fear, like joy or curiosity, is contagious among beasts and birds, as it is among men; the young fox or wolf would instantly share the emotion of its parent in the presence of a trap. It is very important to the wild creatures that they have a quick apprehension of danger, and as a matter of fact they have. One wild and suspicious duck in a flock will often defeat the best laid plans of the duck-hunter. Its suspicions are quickly communicated to all its fellows: not through any conscious effort on its part to do so, but through the law of natural contagion above referred to. Where any bird or beast is much hunted, fear seems to be in the air, and their fellows come to be conscious of the danger which they have not experienced.

What an animal lacks in wit it makes up in caution. Fear is a good thing for the wild creatures to have in superabundance. It often saves them from real danger. But how indiscriminating it is! It is

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said that an iron hoop or wagon-tire placed around a setting hen in the woods will protect her from the foxes.

Animals are afraid on general principles. Anything new and strange excites their suspicions. In a herd of animals, cattle, or horses, fear quickly becomes a panic and rages like a conflagration. Cattle-men in the West found that any little thing at night might kindle the spark in their herds and sweep the whole mass away in a furious stampede. Each animal excites every other, and the multiplied fear of the herd is something terrible. Panics among men are not much different.

In a discussion like the present one, let us use words in their strict logical sense, if possible. Most of the current misconceptions in natural history, as in other matters, arise from a loose and careless use of words. One says teach and train and instruct, when the facts point to instinctive imitation or unconscious communication.

That the young of all kinds thrive better and develop more rapidly under the care of their parents than when deprived of that care is obvious enough. It would be strange if it were not so. Nothing can quite fill the place of the mother with either man or bird or beast. The mother provides and protects. The young quickly learn of her through the natural instinct of imitation. They share her fears, they follow in her footsteps, they look to her for protection.

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it is the order of nature. They are not trained in the way they should go, as a child is by its human parents — they are not trained at all; but their natural instincts doubtless act more promptly and surely with the mother than without her. That a young kingfisher or a young osprey would, in due time, dive for fish, or a young marsh hawk catch mice and birds, or a young fox or wolf or coon hunt for its proper prey without the parental example, admits of no doubt at all; but they would each probably do this thing earlier and better in the order of nature than if that order were interfered with.

The other day I saw a yellow-bellied woodpecker alight upon a decaying beech and proceed to drill for a grub. Two of its fully grown young followed it and, alighting near, sidled up to where the parent was drilling. A hasty observer would say that the parent was giving its young a lesson in grub-hunting, but I read the incident differently. The parent bird had no thought of its young. It made passes at them when they came too near, and drove them away. Presently it left the tree, whereupon one of the young examined the hole its parent had made and drilled a little on its own account. A parental example like this may stimulate the young to hunt for grubs earlier than they would otherwise do, but this is merely conjecture. There is no proof of it, nor can there be any.

The mother bird or beast does not have to be

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instructed in her maternal duties: they are instinctive with her; it is of vital importance to the continuance of the species that they should be. If it were a matter of instruction or acquired knowledge, how precarious it would be!

The idea of teaching is an advanced idea, and can come only to a being that is capable of returning upon itself in thought, and that can form abstract conceptions — conceptions that float free, so to speak, dissociated from particular concrete objects.

If a fox, or a wolf, for instance, were capable of reflection and of dwelling upon the future and upon the past, it might feel the need of instructing its young in the matter of traps and hounds, if such a thing were possible without language. When the cat brings her kitten a live mouse, she is not thinking about instructing it in the art of dealing with mice, but is intent solely upon feeding her young. The kitten already knows, through inheritance, about mice. So when the hen leads her brood forth and scratches for them, she has but one purpose — to provide them with food. If she is confined to the coop, the chickens go forth and soon scratch for themselves and snap up the proper insect food.

The mother's care and protection count for much, but they do not take the place of inherited instinct. It has been found that newly hatched chickens, when left to themselves, do not know the difference between edible and non-edible insects, but that they

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soon learn. In such matters the mother hen, no doubt, guides them.

A writer in "Forest and Stream," who has since published a book about his "wild friends," pushes this notion that animals train their young so far that it becomes grotesque. Here are some of the things that this keen observer and exposé of "false natural history" reports that he has seen about his cabin in the woods: He has seen an old crow that hurriedly flew away from his cabin door on his sudden appearance, return and beat its young because they did not follow quickly enough. He has seen a male chewink, while its mate was rearing a second brood, take the first brood and lead them away to a bird-resort (he probably meant to say to a bird-nursery or kindergarten); and when one of the birds wandered back to take one more view of the scenes of its infancy, he has seen the father bird pounce upon it and give it a "severe whipping and take it to the resort again."

He has seen swallows teach their young to fly by gathering them upon fences and telegraph wires and then, at intervals (and at the word of command, I suppose), launching out in the air with them, and swooping and circling about. He has seen a song sparrow, that came to his dooryard for fourteen years (he omitted to say that he had branded him and so knew his bird), teach *his year-old boy to sing* (the italics are mine). This hermit-inclined sparrow wanted to "desert the fields for a life in the woods,"

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but his "wife would not consent." Many a featherless biped has had the same experience with his society-spoiled wife. The puzzle is, how did this masterly observer know that this state of affairs existed between this couple? Did the wife tell him, or the husband? "Hermit" often takes his visitors to a wood thrushes' singing-school, where, "as the birds forget their lesson, they drop out one by one."

He has seen an old rooster teaching a young rooster to crow! At first the old rooster crows mostly in the morning, but later in the season he crows throughout the day, at short intervals, to show the young "the proper thing." "Young birds removed out of hearing will not learn to crow." He hears the old grouse teaching the young to drum in the fall, though he neglects to tell us that he has seen the young in attendance upon these lessons. He has seen a mother song sparrow helping her two-year-old daughter build her nest. He has discovered that the cat talks to her kittens with her ears: when she points them forward, that means "yes;" when she points them backward, that means "no." Hence she can tell them whether the wagon they hear approaching is the butcher's cart or not, and thus save them the trouble of looking out.

And so on through a long list of wild and domestic creatures. At first I suspected this writer was covertly ridiculing a certain other extravagant "observer," but a careful reading of his letter shows him

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to be seriously engaged in the worthy task of exposing "false natural history."

Now the singing of birds, the crowing of cocks, the drumming of grouse, are secondary sexual characteristics. They are not necessary to the lives of the creatures, and are probably more influenced by imitation than are the more important instincts of self-preservation and reproduction. Yet the testimony is overwhelming that birds will sing and roosters crow and turkeys gobble, though they have never heard these sounds; and, no doubt, the grouse and the woodpeckers drum from promptings of the same sexual instinct.

I do not wish to accuse "Hermit" of willfully perverting the facts of natural history. He is one of those persons who read their own fancies into whatever they look upon. He is incapable of disinterested observation, which means he is incapable of observation at all in the true sense. There are no animals that signal to each other with their ears. The movements of the ears follow the movements of the eye. When an animal's attention is directed to any object or sound, its ears point forward; when its attention is relaxed, the ears fall. But with the cat tribe the ears are habitually erect, as those of the horse are usually relaxed. They depress them and revert them, as do many other animals, when angered or afraid.

Certain things in animal life lead me to suspect

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that animals have some means of communication with one another, especially the gregarious animals, that is quite independent of what we mean by language. It is like an interchange or blending of sub-conscious states, and may be analogous to telepathy among human beings. Observe what a unit a flock of birds becomes when performing their evolutions in the air. They are not many, but one, turning and flashing in the sun with a unity and a precision that it would be hard to imitate. One may see a flock of shore-birds that behave as one body: now they turn to the sun a sheet of silver; then, as their dark backs are presented to the beholder, they almost disappear against the shore or the clouds. It would seem as if they shared in a communal mind or spirit, and that what one felt they all felt at the same instant.

In Florida I many times saw large schools of mullets fretting and breaking the surface of the water with what seemed to be the tips of their tails. A large area would be agitated and rippled by the backs or tails of a host of fishes. Then suddenly, while I looked, there would be one splash and every fish would dive. It was a multitude, again, acting as one body. Hundreds, thousands of tails slapped the water at the same instant and were gone.

When the passenger pigeons were numbered by millions, the enormous clans used to migrate from one part of the continent to another. I saw the last

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flight of them up the Hudson River valley in the spring of 1875. All day they streamed across the sky. One purpose seemed to animate every flock and every bird. It was as if all had orders to move to the same point. The pigeons came only when there was beech-mast in the woods. How did they know we had had a beech-nut year? It is true that a few straggling bands were usually seen some days in advance of the blue myriads: were these the scouts, and did they return with the news of the beech-nuts? If so, how did they communicate the intelligence and set the whole mighty army in motion?

The migrations among the four-footed animals that sometimes occur over a large part of the country — among the rats, the gray squirrels, the reindeer of the north — seem to be of a similar character. How does every individual come to share in the common purpose? An army of men attempting to move without leaders and without a written or spoken language becomes a disorganized mob. Not so the animals. There seems to be a community of mind among them in a sense that there is not among men. The pressure of great danger seems to develop in a degree this community of mind and feeling among men. Under strong excitement we revert more or less to the animal state, and are ruled by instinct. It may well be that telepathy — the power to project one's mental or emotional state so as to impress a friend at a distance — is a power which we

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have carried over from our remote animal ancestors. However this may be, it is certain that the sensitiveness of birds and quadrupeds to the condition of one another; their sense of a common danger, of food supplies, of the direction of home under all circumstances, point to the possession of a power which is only rudimentary in us.

Some observers explain these things on the theory that the flocks of birds have leaders, and that their surprising evolutions are guided by calls or signals from these leaders, too quick or too fine for our eyes or ears to catch. I suppose they would explain the movements of the schools of fish and the simultaneous movements of a large number of land animals on the same theory. I cannot accept this explanation. It is harder for me to believe that a flock of birds has a code of calls or signals for all its evolutions — now right, now left, now mount, now swoop — which each individual understands on the instant, or that the hosts of the wild pigeons had their captains and signals, than to believe that out of the flocking instinct there has grown some other instinct or faculty, less understood, but equally potent, that puts all the members of a flock in such complete rapport with one another that the purpose and the desire of one become the purpose and the desire of all. There is nothing in this state of things analogous to a military organization. The relation among the members of the flock is rather that of creatures sharing

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spontaneously the same subconscious or psychic state, and acted upon by the same hidden influence, in a way and to a degree that never occur among men.

The faculty or power by which animals find the way home over or across long stretches of country is quite as mysterious and incomprehensible to us as the spirit of the flock to which I refer. A hive of bees evidently has a collective purpose and plan that does not emanate from any single individual or group of individuals, and which is understood by all without outward communication.

Is there anything which, without great violence to language, may be called a school of the woods? In the sense in which a playground is a school — a playground without rules or methods or a director — there is a school of the woods. It is an unkept, an unconscious school or gymnasium, and is entirely instinctive. In play the young of all animals, no doubt, get a certain amount of training and disciplining that helps fit them for their future careers; but this school is not presided over or directed by parents, though they sometimes take part in it. It is spontaneous and haphazard, without rule or system; but is, in every case, along the line of the future struggle for life of the particular bird or animal. A young marsh hawk which we reared used to play at striking leaves or bits of bark with its talons; kittens play with a ball, or a cob, or a stick, as if

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it were a mouse; dogs race and wrestle with one another as in the chase; ducks dive and sport in the water; doves circle and dive in the air as if escaping from a hawk; birds pursue and dodge one another in the same way; bears wrestle and box; chickens have mimic battles; colts run and leap; fawns probably do the same thing; squirrels play something like a game of tag in the trees; lambs butt one another and skip about the rocks; and so on.

In fact, nearly all play, including much of that of man, takes the form of mock battle, and is to that extent an education for the future. Among the carnivora it takes also the form of the chase. Its spring and motive are, of course, pleasure, and not education; and herein again is revealed the cunning of nature — the power that conceals purposes of its own in our most thoughtless acts. The cat and the kitten play with the live mouse, not to indulge the sense of cruelty, as some have supposed, but to indulge in the pleasure of the chase and unconsciously to practice the feat of capture. The cat rarely plays with a live bird, because the recapture would be more difficult, and might fail. What fisherman would not like to take his big fish over and over again, if he could be sure of doing it, not from cruelty, but for the pleasure of practicing his art? For further light on the subject of the significance of the play of animals, I refer the reader to the work of Professor Karl Groos called "The Play of Animals."

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One of my critics has accused me of measuring all things by the standard of my little farm — of thinking that what is not true of animal life there is not true anywhere. Unfortunately my farm *is* small — hardly a score of acres — and its animal life very limited. I have never seen even a porcupine upon it; but I have a hill where one might roll down, should one ever come my way and be in the mood for that kind of play.¹ I have a few possums, a woodchuck or two, an occasional skunk, some red squirrels and rabbits, and many kinds of song-birds. Foxes occasionally cross my acres; and once, at least, I saw a bald eagle devouring a fish in one of my apple-trees. Wild ducks, geese, and swans in spring and fall pass across the sky above me. Quail and grouse invade my premises, and of crows I have, at least in bird-nesting time, too many.

But I have a few times climbed over my pasture wall and wandered into distant fields. Once upon a time I was a traveler in Asia for the space of two hours — an experience that ought to have yielded me some startling discoveries, but did not. Indeed, the wider I have traveled and observed nature, the more I am convinced that the wild creatures behave just about the same in all parts of the country; that is, under similar conditions. What one observes truly about bird or beast upon his farm of ten acres, he will not have to unlearn, travel as wide or as far as

¹ See comment on the story here alluded to on page 244.

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he will. Where the animals are much hunted, they are of course much wilder and more cunning than where they are not hunted. In the Yellowstone National Park we found the elk, deer, and mountain sheep singularly tame; and in the summer, so we were told, the bears board at the big hotels. The wild geese and ducks, too, were tame; and the red-tailed hawk built its nest in a large dead oak that stood quite alone near the side of the road. With us the same hawk hides its nest in a tree in the dense woods, because the farmers unwisely hunt and destroy it. But the cougars and coyotes and bobcats were no tamer in the park than they are in other places where they are hunted.

Indeed, if I had elk and deer and caribou and moose and bears and wildcats and beavers and otters and porcupines on my farm, I should expect them to behave just as they do in other parts of the country under like conditions: they would be tame and docile if I did not molest them, and wild and fierce if I did. They would do nothing out of character in either case.

Your natural history knowledge of the East will avail you in the West. There is no country, says Emerson, in which they do not wash the pans and spank the babies; and there is no country where a dog is not a dog, or a fox a fox, or where a hare is ferocious, or a wolf lamblike. The porcupine behaves in the Rockies just as he does in the Catskills;

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the deer and the moose and the black bear and the beaver of the Pacific slope are almost identical in their habits and traits with those of the Atlantic slope.

In my observations of the birds of the far West, I went wrong in my reckoning but once: the Western meadowlark has a new song. How or where he got it is a mystery; it seems to be in some way the gift of those great, smooth, flowery, treeless, dimpled hills. But the swallow was familiar, and the robin and the wren and the highhole, while the woodchuck I saw and heard in Wyoming might have been the "chuck" of my native hills. The eagle is an eagle the world over. When I was a boy I saw, one autumn day, an eagle descend with extended talons upon the backs of a herd of young cattle that were accompanied by a cosset-sheep and were feeding upon a high hill. The object of the eagle seemed to be to separate the one sheep from the cattle, or to frighten them all into breaking their necks in trying to escape him. But neither result did he achieve. In the Yellowstone Park, President Roosevelt and Major Pitcher saw a golden eagle trying the same tactics upon a herd of elk that contained one yearling. The eagle doubtless had his eye upon the yearling, though he would probably have been quite satisfied to have driven one of the older ones down a precipice. His chances of a dinner would have been equally good.

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There is one particular in which the bird families are much more human than our four-footed kindred. I refer to the practice of courtship. The male of all birds, so far as I know, pays suit to the female and seeks to please and attract her.¹ This the quadrupeds do not do; there is no period of courtship among them, and no mating or pairing as among the birds. The male fights for the female, but he does not seek to win her by delicate attentions. If there are any exceptions to this rule, I do not know them. There seems to be among the birds something that is like what is called romantic love. The choice of mate seems always to rest with the female,¹ while among the mammals the female shows no preference at all.

Among our own birds, the prettiest thing I know of attending the period of courtship, or preliminary to the match-making, is the spring musical festival and reunion of the goldfinches, which often lasts for days, through rain and shine. In April or May, apparently all the goldfinches from a large area collect in the top of an elm or a maple and unite in a prolonged musical festival. Is it a contest among the males for the favor of the females, or is it the spontaneous expression of the gladness of the whole clan at the return of the season of life and love? The birds seem to pair soon after, and doubtless the concert of voices has some reference to that event.

¹ Except in the case of certain birds of India and Australia.

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There is one other human practice often attributed to the lower animals that I must briefly consider, and that is the practice, under certain circumstances, of poisoning their young. One often hears of caged young birds being fed by their parents for a few days and then poisoned; or of a mother fox poisoning her captive young when she finds that she cannot liberate him; and such stories obtain ready credence with the public, especially with the young. To make these stories credible, one must suppose a school of pharmacy, too, in the woods.

“The worst thing about these poisoning stories,” writes a friend of mine, himself a writer of nature-books, “is the implied appreciation of the full effect and object of poison — the comprehension by the fox, for instance, that the poisoned meat she may be supposed to find was placed there for the object of killing herself (or some other fox), and that she may apply it to another animal for that purpose. Furthermore, that she understands the nature of death — that it brings ‘surcease of sorrow,’ and that death is better than captivity for her young one. How did she acquire all this knowledge? Where was her experience of its supposed truth obtained? How could she make so fine and far-seeing a judgment, wholly out of the range of brute affairs, and so purely philosophical and humanly ethical? It violates every instinct and canon of natural law, which is for the preservation of life at all hazards.

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This is simply the human idea of 'murder.' Animals kill one another for food, or in rivalry, or in blind ferocity of predatory disposition; but there is not a particle of evidence that they 'commit murder' for ulterior ends. It is questionable whether they comprehend the condition called death, or its nature, in any proper sense."

On another occasion I laughed at a recent nature writer for his credulity in half-believing the story told him by a fisherman, that the fox catches crabs by using his tail as a bait; and yet I read in Romanes that Olaus, in his account of Norway, says he has seen a fox do this very thing among the rocks on the sea-coast.¹ One would like to cross-question Olaus before accepting such a statement. One would as soon expect a fox to put his brush in the fire as in the water. When it becomes wet and bedraggled, he is greatly handicapped as to speed. There is no doubt that rats will put their tails into jars that contain liquid food they want, and then lick them off, as Romanes proved; but the rat's tail is not a brush, nor in any sense an ornament. Think what the fox-and-crab story implies! Now the fox is entirely a land animal, and lives by preying upon land crea-

¹ A book published in London in 1783, entitled *A Geographical, Historical, and Commercial Grammar and the Present State of the Several Kingdoms of the World*, among other astonishing natural history notes, makes this statement about the white and red fox of Norway: "They have a particular way of drawing crabs ashore by dipping their tails in the water, which the crab lays hold of."

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tures, which it follows by scent or sight. It can neither see nor smell crabs in the deep water, where crabs are usually found. How should it know that there are such things as crabs? How should it know that they can be taken with bait and line or by fishing for them? When and how did it get this experience? This knowledge belongs to man alone. It comes through a process of reasoning that he alone is capable of. Man alone of land animals sets traps and fishes. There is a fish called the angler (*Lophius piscatorius*), which, it is said on doubtful authority, by means of some sort of appendages on its head angles for small fish; but no competent observer has reported any land animal doing so. Again, would a crab lay hold of a mass of fur like a fox's tail? — even if the tail could be thrust deep enough into the water, which is impossible. Crabs, when not caught with hand-nets, are usually taken in water eight or ten feet deep. They are baited and caught with a piece of meat tied to a string, but cannot be lifted to the surface till they are eating the meat, and then a dip-net is required to secure them. The story, on the whole, is one of the most preposterous that ever gained credence in natural history.

Good observers are probably about as rare as good poets. Accurate seeing, — an eye that takes in the whole truth, and nothing but the truth, — how rare indeed it is! So few persons know or can tell

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exactly what they see; so few persons can draw a right inference from an observed fact; so few persons can keep from reading their own thoughts and preconceptions into what they see; only a person with the scientific habit of mind can be trusted to report things as they are. Most of us, in observing the wild life about us, see more or see less than the truth. We see less when our minds are dull, or preoccupied, or blunted by want of interest. This is true of most country people. We see more when we read the lives of the wild creatures about us in the light of our human experience, and impute to the birds and beasts human motives and methods. This is too often true of the eager city man or woman who sallies out into the country to study nature.

The tendency to sentimentalize nature has, in our time, largely taken the place of the old tendency to demonize and spiritize it. It is anthropomorphism in another form, less fraught with evil to us, but equally in the way of a clear understanding of the life about us.

VII

DEVIOUS PATHS

THERE is no better type or epitome of wild nature than the bird's-nest — something built, and yet as if it grew, a part of the ground, or of the rock, or of the branch upon which it is placed; beginning so coarsely, so irregularly, and ending so finely and symmetrically; so unlike the work of hands, and yet the result of a skill beyond hands; and when it holds its complement of eggs, how pleasing, how suggestive!

The bird adapts means to an end, and yet so differently from the way of man, — an end of which it does not know the value or the purpose. We know it is prompted to it by the instinct of reproduction. When the woodpecker in the fall excavates a lodge in a dry limb, we know he is prompted to it by the instinct of self-preservation, but the birds themselves obey the behests of nature without knowledge.

A bird's-nest suggests design, and yet it seems almost haphazard; the result of a kind of madness, yet with method in it. The hole the woodpecker drills for its cell is to the eye a perfect circle, and the

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rim of most nests is as true as that of a cup. The circle and the sphere exist in nature; they are mother forms and hold all other forms. They are easily attained; they are spontaneous and inevitable. The bird models her nest about her own breast; she turns round and round in it, and its circular character results as a matter of course. Angles, right lines, measured precision, so characteristic of the works of man, are rarely met with in organic nature.

Nature reaches her ends by devious paths; she loiters, she meanders, she plays by the way; she surely "arrives," but it is always in a blind, hesitating, experimental kind of fashion. Follow the tunnels of the ants or the crickets, or of the moles and the weasels, underground, or the courses of the streams or the paths of the animals above ground — how they turn and hesitate, how wayward and undecided they are! A right line seems out of the question.

The oriole often weaves strings into her nest; sometimes she binds and overhands the part of the rim where she alights in going in, to make it stronger, but it is always done in a hit-or-miss, childish sort of way, as one would expect it to be; the strings are massed, or snarled, or left dangling at loose ends, or are caught around branches; the weaving and the sewing are effective, and the whole nest is a marvel of blind skill, of untaught intelligence; yet how

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unmethodical, how delightfully irregular, how unmistakably a piece of wild nature!

Sometimes the instinct of the bird is tardy, and the egg of the bird gets ripe before the nest is ready; in such a case the egg is of course lost. I once found the nest of the black and white creeping warbler in a mossy bank in the woods, and under the nest was an egg of the bird. The warbler had excavated the site for her nest, dropped her egg into it, and then gone on with her building. Instinct is not always inerrant. Nature is wasteful, and plays the game with a free hand. Yet what she loses on one side she gains on another; she is like that least bittern Mr. Frank M. Chapman tells about. Two of the bittern's five eggs had been punctured by the long-billed marsh wren. When the bird returned to her nest and found the two eggs punctured, she made no outcry, showed no emotion, but deliberately proceeded to eat them. Having done this, she dropped the empty shells over the side of the nest, together with any straws that had become soiled in the process, cleaned her bill, and proceeded with her incubation. This was Nature in a nut-shell, — or rather egg-shell, — turning her mishaps to some good account. If the egg will not make a bird, it will make food; if not food, then fertilizer.

Among nearly all our birds, the female is the active business member of the partnership; she has a turn for practical affairs; she chooses the site of

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the nest, and usually builds it unaided. The life of the male is more or less a holiday or picnic till the young are hatched, when his real cares begin, for he does his part in feeding them. One may see the male cedar-bird attending the female as she is busy with her nest-building, but never, so far as I have observed, assisting her. One spring I observed with much interest a phœbe-bird building her nest not far from my cabin in the woods. The male looked on approvingly, but did not help. He perched most of the time on a mullein stalk near the little spring run where Phœbe came for mud. In the early morning hours she made her trips at intervals of a minute or two. The male flirted his tail and called encouragingly, and when she started up the hill with her load he would accompany her part way, to help her over the steepest part, as it were, then return to his perch and watch and call for her return. For an hour or more I witnessed this little play in bird life, in which the female's part was so primary and the male's so secondary. There is something in such things that seems to lend support to Professor Lester F. Ward's contention, as set forth in his "Pure Sociology," that in the natural evolution of the two sexes the female was first and the male second ; that he was made from her rib, so to speak, and not she from his.

With our phalarope and a few Australian birds, the position of the two sexes as indicated above

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is reversed, the females having the ornaments and bright colors and doing the courting, while the male does the incubating. In a few cases also the female is much the more masculine, noisy, and pugnacious. With some of our common birds, such as the woodpeckers, the chickadee, and the swallows, both sexes take part in nest-building.

It is a very pretty sight to witness a pair of wood thrushes building their nest. Indeed, what is there about the wood thrush that is not pleasing? He is a kind of visible embodied melody. Some birds are so sharp and nervous and emphatic in their movements, as the common snowbird or junco, the flashing of whose white tail quills expresses the character of the bird. But all the ways of the wood thrush are smooth and gentle, and suggest the melody of its song. It is the only bird thief I love to see carrying off my cherries. It usually takes only those dropped upon the ground by other birds, and with the red or golden globe impaled upon its beak, its flight across the lawn is a picture delightful to behold. One season a pair of them built a nest in a near-by grove; morning after morning, for many mornings, I used to see the two going to and from the nest, over my vineyard and currant patch and pear orchard, in quest of, or bringing material for, the structure. They flew low, the female in the lead, the male just behind in line with her, timing his motions to hers, the two making a brown, gently undulating line, very pretty

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to look upon, from my neighbor's field where they obtained the material, to the tree that held the nest. A gentle, gliding flight, hurried but hushed, as it were, and expressive of privacy and loving preoccupation. The male carried no material; apparently he was simply the escort of his mate; but he had an air of keen and joyous interest. He never failed to attend her each way, keeping about a yard behind her, and flying as if her thought were his thought and her wish his wish. I have rarely seen anything so pretty in bird life. The movements of all our thrushes except the robin give one this same sense of harmony, — nothing sharp or angular or abrupt. Their gestures are as pleasing as their notes.

One evening, while seated upon my porch, I had convincing proof that musical or song contests do take place among the birds. Two wood thrushes who had nests near by sat on the top of a dead tree and pitted themselves against each other in song for over half an hour, contending like champions in a game, and certainly affording the rarest treat in wood thrush melody I had ever had. They sang and sang with unwearied spirit and persistence, now and then changing position or facing in another direction, but keeping within a few feet of each other. The rivalry became so obvious and was so interesting that I finally made it a point not to take my eyes from the singers. The twilight deepened till their forms began to grow dim; then one of the

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birds could stand the strain no longer, the limit of fair competition had been reached, and seeming to say, "I will silence you, anyhow," it made a spiteful dive at its rival, and in hot pursuit the two disappeared in the bushes beneath the tree. Of course I would not say that the birds were consciously striving to outdo each other in song ; it was the old feud between males in the love season, not a war of words or of blows, but of song. Had the birds been birds of brilliant plumage, the rivalry would probably have taken the form of strutting and showing off their bright colors and ornaments.

An English writer on birds, Edmund Selous, describes a similar song contest between two nightingales. "Jealousy," he says, "did not seem to blind them to the merit of each other's performance. Though often one, upon hearing the sweet, hostile strains, would burst forth instantly itself, — and here there was no certain mark of appreciation, — yet sometimes, perhaps quite as often, it would put its head on one side and listen with exactly the appearance of a musical connoisseur, weighing, testing, and appraising each note as it issued from the rival bill. A curious, half-suppressed expression would steal, or seem to steal (for Fancy may play her part in such matters), over the listening bird, and the idea appear to be, 'How exquisite would be those strains were they not sung by —, and yet I must admit that they are exquisite.'" Fancy no

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doubt does play a part in such matters. It may well be doubted if birds are musical connoisseurs, or have anything like human appreciation of their own or of each other's songs. My reason for thinking so is this: I have heard a bobolink with an instrument so defective that its song was broken and inarticulate in parts, and yet it sang with as much apparent joy and abandon as any of its fellows. I have also heard a hermit thrush with a similar defect or impediment that appeared to sing entirely to its own satisfaction. It would be very interesting to know if these poor singers found mates as readily as their more gifted brothers. If they did, the Darwinian theory of "sexual selection" in such matters, according to which the finer songster would carry off the female, would fall to the ground. Yet it is certain that it is during the mating and breeding season that these "song combats" occur, and the favor of the female would seem to be the matter in dispute. Whether or not it be expressive of actual jealousy or rivalry, we have no other words to apply to it.

A good deal of light is thrown upon the ways of nature as seen in the lives of our solitary wasps, so skillfully and charmingly depicted by George W. Peckham and his wife in their work on those insects. So whimsical, so fickle, so forgetful, so fussy, so wise, and yet so foolish, as these little people are! such victims of routine and yet so individual, such

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apparent foresight and yet such thoughtlessness, at such great pains and labor to dig a hole and build a cell, and then at times sealing it up without storing it with food or laying the egg, half finishing hole after hole, and then abandoning them without any apparent reason; sometimes killing their spiders, at other times only paralyzing them; one species digging its burrow before it captures its game, others capturing the game and then digging the hole; some of them hanging the spider up in the fork of a weed to keep it away from the ants while they work at their nest, and running to it every few minutes to see that it is safe; others laying the insect on the ground while they dig; one species walking backward and dragging its spider after it, and when the spider is so small that it carries it in its mandible, still walking backward as if dragging it, when it would be much more convenient to walk forward. A curious little people, leading their solitary lives and greatly differentiated by the solitude, hardly any two alike, one nervous and excitable, another calm and unhurried; one careless in her work, another neat and thorough; this one suspicious, that one confiding; *Ammophila* using a pebble to pack down the earth in her burrow, while another species uses the end of her abdomen, — verily a queer little people, with a lot of wild nature about them, and a lot of human nature, too.

I think one can see how this development of in-

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dividuality among the solitary wasps comes about. May it not be because the wasps are solitary? They live alone. They have no one to imitate; they are uninfluenced by their fellows. No community interests override or check individual whims or peculiarities. The innate tendency to variation, active in all forms of life, has with them full sway. Among the social bees or wasps one would not expect to find those differences between individuals. The members of a colony all appear alike in habits and in dispositions. Colonies differ, as every bee-keeper knows, but probably the members composing it differ very little. The community interests shape all alike. Is it not the same in a degree among men? Does not solitude bring out a man's peculiarities and differentiate him from others? The more one lives alone, the more he becomes unlike his fellows. Hence the original and racy flavor of woodsmen, pioneers, lone dwellers in Nature's solitudes. Thus isolated communities develop characteristics of their own. Constant intercommunication, the friction of travel, of streets, of books, of newspapers, make us all alike; we are, as it were, all pebbles upon the same shore, washed by the same waves.

Among the larger of vertebrate animals, I think, one might reasonably expect to find more individuality among those that are solitary than among those that are gregarious; more among birds of prey than among water-fowl, more among foxes than among

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prairie-dogs, more among moose than among sheep or buffalo, more among grouse than among quail. But I do not know that this is true.

Yet among none of these would one expect to find the diversity of individual types that one finds among men. No two dogs of the same breed will be found to differ as two men of the same family often differ. An original fox, or wolf, or bear, or beaver, or crow, or crab, — that is, one not merely different from his fellows, but obviously superior to them, differing from them as a master mind differs from the ordinary mind, — I think, one need not expect to find. It is quite legitimate for the animal-story writer to make the most of the individual differences in habits and disposition among the animals; he has the same latitude any other story writer has, but he is bound also by the same law of probability, the same need of fidelity to nature. If he proceed upon the theory that the wild creatures have as pronounced individuality as men have, that there are master minds among them, inventors and discoverers of new ways, born captains and heroes, he will surely “o’erstep the modesty of nature.”

The great diversity of character and capacity among men doubtless arises from their greater and more complex needs, relations, and aspirations. The animals’ needs in comparison are few, their relations simple, and their aspirations *nil*. One cannot see what could give rise to the individual types

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and exceptional endowments that are often claimed for them. The law of variation, as I have said, would give rise to differences, but not to a sudden reversal of race habits, or to animal geniuses.

The law of variation is everywhere operative — less so now, no doubt, than in the earlier history of organic life on the globe. Yet Nature is still experimenting in her blind way, and hits upon many curious differences and departures. But I suppose if the race of man were exterminated, man would never arise again. I doubt if the law of evolution could ever again produce him, or any other species of animal.

This principle of variation was no doubt much more active back in geologic time, during the early history of animal life upon the globe, than it is in this late age. And for the reason that animal life was less adapted to its environment than it is now, the struggle for life was sharper. Perfect adaptation of any form of life to the conditions surrounding it seems to check variability. Animal and plant life seem to vary more in this country than in England because the conditions of life are harder. The extremes of heat and cold, of wet and dry, are much greater. It has been found that the eggs of the English sparrow vary in form and color more in the United States than in Great Britain. Certain American shells are said to be more variable than the English. Among our own birds it has been found that

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the "migratory species evince a greater amount of individual variation than do non-migrating species" because they are subject to more varying conditions of food and climate. I think we may say, then, if there were no struggle for life, if uniformity of temperature and means of subsistence everywhere prevailed, there would be little or no variation and no new species would arise. The causes of variation seem to be the inequality and imperfection of things; the pressure of life is unequally distributed, and this is one of Nature's ways that accounts for much that we see about us.

VIII

WHAT DO ANIMALS KNOW?

AFTER the discussion carried on in the foregoing chapters touching the general subject of animal life and instinct, we are prepared, I think, to ask with more confidence, What do animals know?

The animals unite such ignorance with such apparent knowledge, such stupidity with such cleverness, that in our estimate of them we are likely to rate their wit either too high or too low. With them, knowledge does not fade into ignorance, as it does in man; the contrast is like that between night and day, with no twilight between. So keen one moment, so blind the next!

Think of the ignorance of the horse after all his long association with man; of the trifling things along the street at which he will take fright, till he rushes off in a wild panic of fear, endangering his own neck and the neck of his driver. One would think that if he had a particle of sense he would know that an old hat or a bit of paper was harmless. But fear is deeply implanted in his nature; it has saved the lives of his ancestors countless times, and it is still one of his ruling passions.

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I have known a cow to put her head between two trees in the woods — a kind of natural stanchion — and not have wit enough to get it out again, though she could have done so at once by lifting her head to a horizontal position. But the best instance I know of the grotesque ignorance of a cow is given by Hamerton in his "Chapters on Animals." The cow would not "give down" her milk unless she had her calf before her. But her calf had died, so the herdsman took the skin of the calf, stuffed it with hay, and stood it up before the inconsolable mother. Instantly she proceeded to lick it and to yield her milk. One day, in licking it, she ripped open the seams, and out rolled the hay. This the mother at once proceeded to eat, without any look of surprise or alarm. She liked hay herself, her acquaintance with it was of long standing, and what more natural to her than that her calf should turn out to be made of hay! Yet this very cow that did not know her calf from a bale of hay would have defended her young against the attack of a bear or a wolf in the most skillful and heroic manner; and the horse that was nearly frightened out of its skin by a white stone, or by the flutter of a piece of newspaper by the roadside, would find its way back home over a long stretch of country, or find its way to water in the desert, with a certainty you or I could not approach.

The hen-hawk that the farm-boy finds so difficult to approach with his gun will yet alight upon

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his steel trap fastened to the top of a pole in the fields. The rabbit that can be so easily caught in a snare or in a box-trap will yet conceal its nest and young in the most ingenious manner. Where instinct or inherited knowledge can come into play, the animals are very wise, but new conditions, new problems, bring out their ignorance.

A college girl told me an incident of a red squirrel she had observed at her home in Iowa that illustrates how shallow the wit of a squirrel is when confronted by new conditions. This squirrel carried nuts all day and stored them in the end of a drain-pipe that discharged the rain-water upon the pavement below. The nuts obeyed the same law that the rain-water did, and all rolled through the pipe and fell upon the sidewalk. In the squirrel's experience, and in that of his forbears, all holes upon the ground were stopped at the far end, or they were like pockets, and if nuts were put in them they stayed there. A hollow tube open at both ends, that would not hold nuts — this was too much for the wit of the squirrel. But how wise he is about the nuts themselves!

Among the lower animals the ignorance of one is the ignorance of all, and the knowledge of one is the knowledge of all, in a sense in which the same is not true among men. Of course some are more stupid than others of the same species, but probably, on the one hand, there are no idiots among them, and, on the other, none is preëminent in wit.

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Animals take the first step in knowledge — they perceive things and discriminate between them; but they do not take the second step — combine them, analyze them, and form concepts and judgments.

So that, whether animals know much or little, I think we are safe in saying that what they know in the human way, that is, from a process of reasoning, is very slight.

The animals all have in varying degrees perceptive intelligence. They know what they see, hear, smell, feel, so far as it concerns them to know it. They know their kind, their mates, their enemies, their food, heat from cold, hard from soft, and a thousand other things that it is important that they should know, and they know these things just as we know them, through their perceptive powers.

We may ascribe intelligence to the animals in the same sense in which we ascribe it to a child, as the perception of the differences or of the likenesses and the relations of things — that is, perceptive intelligence, but not reasoning intelligence. When the child begins to “notice things,” to know its mother, to fear strangers, to be attracted by certain objects, we say it begins to show intelligence. Development in this direction goes on for a long time before it can form any proper judgment about things or take the step of reason.

If we were to subtract from the sum of the intelligence of an animal that which it owes to nature or

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inherited knowledge, the amount left, representing its own power of thought, would be very small. Darwin tells of a pike in an aquarium separated by plate-glass from fish which were its proper food, and that the pike, in trying to capture the fish, would often dash with such violence against the glass as to be completely stunned. This the pike did for three months before it learned caution. After the glass was removed, the pike would not attack those particular fishes, but would devour others that were introduced. It did not yet understand the situation, but merely associated the punishment it had received with a particular kind of fish.

During the mating season the males of some of our birds may often be seen dashing themselves against a window, and pecking and fluttering against the pane for hours at a time, day after day. They take their own images reflected in the glass to be rival birds, and are bent upon demolishing them. They never comprehend the mystery of the glass, because glass is not found in nature, and neither they nor their ancestors have had any experience with it.

Contrast these incidents with those which Darwin relates of the American monkeys. When the monkeys had cut themselves once with any sharp tool, they would not touch it again, or else would handle it with the greatest caution. They evinced the simpler forms of reason, of which monkeys are no doubt capable.

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Animals are wise as Nature is wise; they partake, each in its own measure, of that universal intelligence, or mind-stuff, that is operative in all things — in the vegetable as well as in the animal world. Does the body, or the life that fills it, reason when it tries to get rid of, or to neutralize the effects of, a foreign substance, like a bullet, by encysting it? or when it thickens the skin on the hand or on any other part of the body, even forming special pads called callosities, as a result of the increased wear or friction? This may be called physiological intelligence.

But how blind this intelligence is at times, or how wanting in judgment, may be seen when it tries to develop a callosity upon the foot as a result of the friction of the shoe, and overdoes the matter and produces the corn. The corn is a physiological blunder. Or see an unexpected manifestation of this intelligence when we cut off the central and leading shoot of a spruce or of a pine tree, and straightway one of the lateral and horizontal branches rises up, takes the place of the lost leader, and carries the tree upward; or in the roots of a tree working their way through the ground much like molten metal, parting and uniting, taking the form of whatever object they touch, shaping themselves to the rock, flowing into its seams, the better to get a grip upon the earth and thus maintain an upright position.

In the animal world this foresight becomes psychic

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intelligence, developing in man the highest form of all, reasoned intelligence. When an animal solves a new problem or meets a new condition as effectually as the tree or the body does in the cases I have just cited, we are wont to ascribe to it powers of reason. Reason we may call it, but it is reason not its own.

This universal or cosmic intelligence makes up by far the greater part of what animals know. The domestic animals, such as the dog, that have long been under the tutelage of man, of course show more independent power of thought than the uneducated beasts of the fields and woods.

The plant is wise in all ways to reproduce and perpetuate itself; see the many ingenious devices for scattering seed. In the animal world this intelligence is most keen and active in the same direction. The wit of the animal comes out most clearly in looking out for its food and safety. We are often ready to ascribe reason to it in feats shown in these directions.

In man alone does this universal intelligence or mind-stuff reach out beyond these primary needs and become aware of itself. What the plant or the animal does without thought or rule, man takes thought about. He considers his ways. I noticed that the scallops in the shallow water on the beach had the power to anchor themselves to stones or to some other object, by putting out a little tough but elastic cable from near the hinge, and that they did so when

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the water was rough; but I could not look upon it as an act of conscious or individual intelligence on the part of the bivalve. It was as much an act of the general intelligence to which I refer as was its hinge or its form. But when the sailor anchors his ship, that is another matter. He thinks about it, he reasons from cause to effect, he sees the storm coming, he has a fund of experience, and his act is a special individual act.

The muskrat builds its house instinctively, and all muskrats build alike. Man builds his house from reason and forethought. Savages build as nearly alike as the animals, but civilized man shows an endless variety. The higher the intelligence, the greater the diversity.

The sitting bird that is so solicitous to keep its eggs warm, or to feed and defend its young, probably shows no more independent and individual intelligence than the plant that strives so hard to mature and scatter its seed. A plant will grow toward the light; a tree will try to get from under another tree that overshadows it; a willow will run its roots toward the water: but these acts are the results of external stimuli alone.

When I go to pass the winter in a warmer climate, the act is the result of calculation and of weighing pros and cons. I can go, or I can refrain from going. Not so with the migrating birds. Nature plans and thinks for them; it is not an individual act on

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the part of each; it is a race instinct: they must go; the life of the race demands it. Or when the old goose covers up her nest, or the rabbit covers her young with a blanket of hair and grass of her own weaving, I do not look upon these things as independent acts of intelligence: it is the cunning of nature; it is a race instinct.

Animals, on the whole, know what is necessary for them to know — what the conditions of life have taught their ancestors through countless generations. It is very important, for instance, that amphibians shall have some sense that shall guide them to the water; and they have such a sense. It is said that young turtles and crocodiles put down anywhere will turn instantly toward the nearest water. It is certain that the beasts of the field have such a sense much more fully developed than has man. It is of vital importance that birds should know how to fly, how to build their nests, how to find their proper food, and when and where to migrate, without instruction or example, otherwise the race might become extinct.

Richard Jefferies says that most birds'-nests need a structure around them like a cage to keep the young from falling out or from leaving the nest prematurely. Now, if such a structure were needed, either the race of birds would have failed, or the structure would have been added. Since neither has happened, we are safe in concluding it is not needed.

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We are not warranted in attributing to any wild, untrained animal a degree of intelligence that its forbears could not have possessed. The animals for the most part act upon inherited knowledge, that is, knowledge that does not depend upon instruction or experience. For instance, the red squirrels near me seem to know that chestnut-burs will open if cut from the tree and allowed to lie upon the ground. At least, they act upon this theory. I do not suppose this fact or knowledge lies in the squirrel's mind as it would in that of a man — as a deduction from facts of experience or of observation. The squirrel cuts off the chestnuts because he is hungry for them, and because his ancestors for long generations have cut them off in the same way. That the air or sun will cause the burs to open is a bit of knowledge that I do not suppose he possesses in the sense in which we possess it: he is in a hurry for the nuts, and does not by any means always wait for the burs to open; he frequently chips them up and eats the pale nuts.

The same squirrel will bite into the limbs of a maple tree in spring and suck the sap. What does he know about maple trees and the spring flow of sap? Nothing as a mental concept, as a bit of concrete knowledge. He often finds the sap flowing from a crack or other wound in the limbs of a maple, and he sips it and likes it. Then he sinks his teeth into the limb, as his forbears undoubtedly did.

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When I was a boy and saw, as I often did on my way to school, where a squirrel had stopped on his course through the woods and dug down through two or three feet of snow, bringing up a beech-nut or an acorn, I used to wonder how he knew the nut was there. I am now convinced that he smelled it.

Why should he not? It stands the squirrel in hand to smell nuts; they are his life. He knows a false nut from a good one without biting into it. Try the experiment upon your tame chipmunk or caged gray squirrel, and see if this is not so. The false or dead nut is lighter, and most persons think this fact guides the squirrel. But this, it seems to me, implies an association of ideas beyond the reach of instinct. A young squirrel will reject a worthless nut as promptly as an old one will. Again the sense of smell is the guide; the sound-meated nut has an odor which the other has not. All animals are keen and wise in relation to their food and to their natural enemies. A red squirrel will chip up green apples and pears for the seeds at the core: can he know, on general principles, that these fruits contain seeds? Does not some clue to them reach his senses?

I have known gray squirrels to go many hundred yards in winter across fields to a barn that contained grain in the sheaf. They could have had no other guide to the grain than the sense of smell. Watch a chipmunk or any squirrel near at hand: as a friend of mine observed, he seems to be smelling with his

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whole body; his abdomen fairly palpitates with the effort.

The coon knows when the corn is in the milk, gaining that knowledge, no doubt, through his nose. At times he seems to know enough, too, to cut off his foot when caught in a trap, especially if the foot becomes frozen; but if you tell me he will treat his wound by smearing it with pitch or anything else, or in any way except by licking it, I shall discredit you. The practice of the art of healing by the application of external or foreign substances is a conception entirely beyond the capacity of any of the lower animals. If such a practice had been necessary for the continuance of the species, it would probably have been used. The knowledge it implies could not be inherited; it must needs come by experience. When a fowl eats gravel or sand, is it probable that the fowl knows what the practice is for, or has any notion at all about the matter? It has a craving for the gravel, that is all. Nature is wise for it.

The ostrich is described by those who know it intimately as the most stupid and witless of birds, and yet before leaving its eggs exposed to the hot African sun, the parent bird knows enough to put a large pinch of sand on the top of each of them, in order, it is said, to shade and protect the germ, which always rises to the highest point of the egg. This act certainly cannot be the result of knowledge, as

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we use the term; the young ostrich does it as well as the old. It is the inherited wisdom of the race, or instinct.

A sitting bird or fowl turns its eggs at regular intervals, which has the effect of keeping the yolk from sticking to the shell. Is this act the result of knowledge or of experience? It is again the result of that untaught knowledge called instinct. Some kinds of eggs hatch in two weeks, some in three, others in four. The mother bird has no knowledge of this period. It is not important that she should have. If the eggs are addled or sterile, she will often continue to sit beyond the normal period. If the continuance of the species depended upon her knowing the exact time required to hatch her eggs, as it depends upon her having the incubating fever, of course she would know exactly, and would never sit beyond the required period.

But what shall we say of Mrs. Annie Martin's story, in her "Home Life on an Ostrich Farm," of the white-necked African crow that, in order to feast upon the eggs of the ostrich, carries a stone high in the air above them and breaks them by letting it fall? This looks like reason, a knowledge of the relation of cause and effect. Mrs. Martin says the crows break tortoise-shells in the same way, and have I not heard of our own crows and gulls carrying clams and crabs into the air and dropping them upon the rocks?

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If Mrs. Martin's statements are literally true, — if she has not the failing, so common among women observers, of letting her feeling and her fancies color her observations, — then her story shows how the pressure of hunger will develop the wit of a crow.

But the story goes one step beyond my credence. It virtually makes the crow a tool-using animal, and Darwin knew of but two animals, the man-like ape and the elephant, that used anything like a tool or weapon to attain their ends. How could the crow gain the knowledge or the experience which this trick implies? What could induce it to make the first experiment of breaking an egg with a falling stone but an acquaintance with physical laws such as man alone possesses? The first step in this chain of causation it is easy to conceive of any animal taking; namely, the direct application of its own powers or weapons to the breaking of the shell. But the second step, — the making use of a foreign substance or object in the way described, — that is what staggers one.

Our own crow has great cunning, but it is only cunning. He is suspicious of everything that looks like design, that suggests a trap, even a harmless string stretched around a corn-field. As a natural philosopher he makes a poor show, and the egg or the shell that he cannot open with his own beak he leaves behind. Yet even his alleged method of dropping clams upon the rocks to break the shells does not

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seem incredible. He might easily drop a clam by accident, and then, finding the shell broken, repeat the experiment. He is still only taking the first step in the sequence of causations.

A recent English nature-writer, on the whole, I think, a good observer and truthful reporter, Mr. Richard Kearton, tells of an osprey that did this incredible thing: to prevent its eggs from being harmed by an enforced exposure to the sun, the bird plunged into the lake, then rose, and shook its dripping plumage over the nest. The writer apparently reports this story at second-hand. It is incredible to me, because it implies a knowledge that the hawk could not possibly possess.

Such an emergency could hardly arise once in a lifetime to it or its forbears. Hence the act could not have been the result of inherited habit, or instinct, and as an original act on the part of the osprey it is not credible. The bird probably plunged into the lake for a fish, and then by accident shook itself above the eggs. In any case, the amount of water that would fall upon the eggs under such circumstances would be too slight to temper appreciably the heat.

There is little doubt that among certain of our common birds the male, during periods of excessive heat, has been known to shade the female with his outstretched wings, and the mother bird to shade her young in the same way. But this is a different

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matter. This emergency must have occurred for ages, and it, again, called only for the first step from cause to effect, and called for the use of no intermediate agent. If the robin were to hold a leaf or a branch above his mate at such times, that would imply reflection.

It is said that elephants in India will besmear themselves with mud as a protection against insects, and that they will break branches from the trees and use them to brush away the flies. If this is true, it shows, I think, something beyond instinct in the elephant; it shows reflection.

All birds are secretive about their nests, and display great cunning in hiding them; but whether they know the value of adaptive material, such as moss, lichens, and dried grass, in helping to conceal them, admits of doubt, because they so often use the results of our own arts, as paper, rags, strings, tinsel, in such a reckless way. In a perfectly wild state they use natural material because it is the handiest and there is really no other. The phoebe uses the moss on or near the rocks where she builds; the sparrows, the bobolinks, and the meadowlarks use the dry grass of the bank or of the meadow bottom where the nest is placed.

The English writer to whom I have referred says that the wren builds the outside of its nest of old hay straws when placing it in the side of a rick, of green moss when it is situated in a mossy bank, and of

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dead leaves when in a hedge-row or a bramble-bush, in each case thus rendering the nest very difficult of detection because it harmonizes so perfectly with its surroundings, and the writer wonders if this harmony is the result of accident or of design. He is inclined to think that it is unpremeditated, as I myself do. The bird uses the material nearest to hand.

Another case, which this same writer gives at second-hand, of a bird recognizing the value of protective coloration, is not credible. A friend of his told him that he had once visited a colony of terns "on an island where the natural breeding accommodation was so limited that many of them had conveyed patches of pebbles on to the grass and laid their eggs thereon."

Here is the same difficulty we have encountered before — one more step of reasoning than the bird is capable of. As a deduction from observed facts, a bird, of course, knows nothing about protective coloring; its wisdom in this respect is the wisdom of Nature, and Nature in animal life never acts with this kind of foresight. A bird may exercise some choice about the background of its nest, but it will not make both nest and background.

Nature learns by endless experiment. Through a long and expensive process of natural selection she seems to have brought the color of certain animals and the color of their environment pretty close together, the better to hide the animals from their

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enemies and from their prey, as we are told; but the animals themselves do not know this, though they may act as if they did. Young terns and gulls instinctively squat upon the beach, where their colors so harmonize with the sand and pebbles that the birds are virtually invisible. Young partridges do the same in the woods, where the eye cannot tell the reddish tuft of down from the dry leaves. How many gulls and terns and partridges were sacrificed before Nature learned this trick!

I regard the lower animals as incapable of taking the step from the fact to the principle. They have perceptions, but not conceptions. They may recognize a certain fact, but any deduction from that fact to be applied to a different case, or to meet new conditions, is beyond them. Wolves and foxes soon learn to be afraid of poisoned meat: just what gives them the hint it would be hard to say, as the survivors could not know the poison's deadly effect from experience; their fear of it probably comes from seeing their fellows suffer and die after eating it, or maybe through that mysterious means of communication between animals to which I have referred in a previous article. The poison probably changes the odor of the meat, and this strange smell would naturally put them on their guard.

We do not expect rats to succeed in putting a bell on the cat, but if they were capable of conceiving such a thing, that would establish their claim to be

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regarded as reasonable beings. I should as soon expect a fox or a wolf to make use of a trap to capture its prey as to make use of poison in any way. Why does not the fox take a stick and spring the trap he is so afraid of? Simply because the act would involve a mental process beyond him. He has not yet learned to use even the simplest implement to attain his end. Then he would probably be just as afraid of the trap after it was sprung as before. He in some way associates it with his arch-enemy, man.

Such stories, too, as a chained fox or a coyote getting possession of corn or other grain and baiting the chickens with it — feigning sleep till the chicken gets within reach, and then seizing it — are of the same class, incredible because transcending the inherited knowledge of those animals. I can believe that a fox might walk in a shallow creek to elude the hound, because he may inherit this kind of cunning, and in his own experience he may have come to associate loss of scent with water. Animals stalk their prey, or lie in wait for it, instinctively, not from a process of calculation, as man does. If a fox would bait poultry with corn, why should he not, in his wild state, bait mice and squirrels with nuts and seeds? Has a cat ever been known to bait a rat with a piece of cheese?

Animals seem to have a certain association of ideas; one thing suggests another to them, as with us. This fact is made use of by animal-trainers. I

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can easily believe the story Charles St. John tells of the fox he saw waylaying some hares, and which, to screen himself the more completely from his quarry, scraped a small hollow in the ground and threw up the sand about it. But if St. John had said that the fox brought weeds or brush to make himself a blind, as the hunter often does, I should have discredited him, just as I discredit the observation of a man quoted by Romanes, who says that jackals, ambushing deer at the latter's watering-place, deliberately wait till the deer have filled themselves with water, knowing that in that state they are more easily run down and captured!

President Roosevelt, in "The Wilderness Hunter," — a book, by the way, of even deeper interest to the naturalist than to the sportsman, — says that the moose has to the hunter the "very provoking habit of making a half or three-quarters circle before lying down, and then crouching with its head so turned that it can surely perceive any pursuer who may follow its trail." This is the cunning of the moose developed through long generations of its hunted and wolf-pursued ancestors, — a cunning that does not differ from that of a man under the same circumstances, though, of course, it is not the result of the same process of reasoning.

I have known a chipping sparrow to build her nest on a grape-vine just beneath a bunch of small green grapes. Soon the bunch grew and lengthened and

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filled the nest, crowding out the bird. If the bird could have foreseen the danger, she would have shown something like human reason.

Birds that nest along streams, such as the water-thrush and the water-ouzel, I suppose are rarely ever brought to grief by high water. They have learned through many generations to keep at a safe distance. I have never known a woodpecker to drill its nesting-cavity in a branch or limb that was ready to fall. Not that woodpeckers look the branch or tree over with a view to its stability, but that they will cut into a tree only of a certain hardness; it is a family instinct. Birds sometimes make the mistake of building their nests on slender branches that a summer tempest will turn over, thus causing the eggs or the young to spill upon the ground. Even instinct cannot always get ahead of the weather.

It is almost impossible for us not to interpret the lives of the lower animals in the terms of our own experience and our own psychology. I entirely agree with Lloyd Morgan that we err when we do so, when we attribute to them what we call sentiments or any of the emotions that spring from our moral and æsthetic natures, — the sentiments of justice, truth, beauty, altruism, goodness, duty, and the like, — because these sentiments are the products of concepts and ideas to which the brute natures are strangers. But all the emotions of our animal nature — fear, anger, curiosity, local attachment,

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jealousy, and rivalry — are undoubtedly the same in the lower orders.

Though almost anything may be affirmed of dogs, for they are nearly half human, yet I doubt if even dogs experience the feeling of shame or guilt or revenge that we so often ascribe to them. These feelings are all complex and have a deep root. When I was a youth, my father had a big churn-dog that appeared one morning with a small bullet-hole in his hip. Day after day the old dog treated his wound with his tongue, after the manner of dogs, until it healed, and the incident was nearly forgotten. One day a man was going by on horseback, when the old dog rushed out, sprang at the man, and came near pulling him from the horse. It turned out that this was the person who had shot the dog, and the dog recognized him.

This looks like revenge, and it would have been such in you or me, but in the dog it was probably simple anger at the sight of the man who had hurt him. The incident shows memory and the association of impressions, but the complex feeling of vengeance, as we know it, is another matter.

If animals do not share our higher intellectual nature, we have no warrant for attributing to them anything like our higher and more complex emotional nature. Musical strains seem to give them pain rather than pleasure, and it is quite evident that perfumes have no attraction for them.

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The stories, which seem to be well authenticated, of sheep-killing dogs that have slipped their collars in the night and indulged their passion for live mutton, and then returned and thrust their necks into their collars before their absence was discovered, do not, to my mind, prove that the dogs were trying to deceive their masters and conceal their guilt, but rather show how obedient to the chain and collar the dogs had become. They had long been subject to such control and discipline, and they returned to them again from the mere force of habit.

I do not believe even the dog to be capable of a sense of guilt. Such a sense implies a sense of duty, and this is a complex ethical sense that the animals do not experience. What the dog fears, and what makes him put on his look of guilt and shame, is his master's anger. A harsh word or a severe look will make him assume the air of a culprit whether he is one or not, and, on the other hand, a kind word and a reassuring smile will transform him into a happy beast, no matter if the blood of his victim is fresh upon him.

A dog is to be broken of a bad habit, if at all, not by an appeal to his conscience or to his sense of duty, for he has neither, but by an appeal to his susceptibility to pain.

Both Pliny and Plutarch tell the story of an elephant which, having been beaten by its trainer for its poor dancing, was afterward found all by itself

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practicing its steps by the light of the moon. This is just as credible as many of the animal stories one hears nowadays.

Many of the actions of the lower animals are as automatic as those of the tin rooster that serves as a weather-vane. See how intelligently the rooster acts, always pointing the direction of the wind without a moment's hesitation. Or behold the vessel anchored in the harbor, how intelligently it adjusts itself to the winds and the tides! I have seen a log, caught in an eddy in a flooded stream, apparently make such struggles to escape that the thing became almost uncanny in its semblance to life. Man himself often obeys just such unseen currents of race or history when he thinks he is acting upon his own initiative.

When I was in Alaska, I saw precipices down which hundreds of horses had dashed themselves in their mad and desperate efforts to escape from the toil and suffering they underwent on the White Pass trail. Shall we say these horses deliberately committed suicide? Suicide it certainly was in effect, but of course not in intention. What does or can a horse know about death, or about self-destruction? These animals were maddened by their hardships, and blindly plunged down the rocks.

The tendency to humanize the animals is more and more marked in all recent nature books that aim at popularity. A recent British book on animal life

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has a chapter entitled "Animal Materia Medica." The writer, to make out his case, is forced to treat as medicine the salt which the herbivorous animals eat, and the sand and gravel which grain and nut-eating birds take into their gizzards to act as mill-stones to grind their grist. He might as well treat their food as medicine and be done with it. So far as I know, animals have no remedies whatever for their ailments. Even savages have, for the most part, only "fake" medicines.

A Frenchman has published a book, which has been translated into English, on the "Industries of Animals." Some of these Frenchmen could give points even to our "Modern School of Nature Study." It may be remembered that Michelet said the bird floated, and that it could puff itself up so that it was lighter than the air! Not a little contemporary natural science can beat the bird in this respect.

The serious student of nature can have no interest in belittling or in exaggerating the intelligence of animals. What he wants is the truth about them, and this he will not get from our natural history romancers, nor from the casual, untrained observers, who are sure to interpret the lives of the wood-folk in terms of their own motives and experiences, nor from Indians, trappers, or backwoodsmen, who give such free rein to their fancies and superstitions.

Such a book as Romanes's "Animal Intelligence"

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is not always a safe guide. It is like a lawyer's plea to the jury for his client. Romanes was so intent upon making out his case that he allowed himself to be imposed upon by the tales of irresponsible observers. Many of his stories of the intelligence of birds and beasts are antecedently improbable. He evidently credits the story of the Bishop of Carlisle, who thinks he saw a jackdaw being tried by a jury of rooks for some misdemeanor. Jack made a speech and the jury cawed back at him, and after a time appeared to acquit Jack! What a child's fancy to be put in a serious work on "Animal Intelligence"! The dead birds we now and then find hanging from the nest, or from the limb of a tree, with a string wound around their necks are no doubt criminals upon whom their fellows have inflicted capital punishment!

Most of the observations upon which Romanes bases his conclusions are like the incident which he quoted from Jesse, who tells of some swallows that in the spirit of revenge tore down a nest from which they had been ejected by the sparrows, in order to destroy the young of their enemies — a feat impossible for swallows to do. Jesse does not say he saw the swallows do it, but he "saw the young sparrows dead upon the ground amid the ruins of the nest," and of course the nest could get down in no other way.

Not to Romanes or Jesse or Michelet must we go

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for the truth about animals, but to the patient, honest Darwin, to such calm, keen, and philosophical investigators as Lloyd Morgan, and to the books of such sportsmen as Charles St. John, or to our own candid, trained, and many-sided Theodore Roosevelt, — men capable of disinterested observation with no theories about animals to uphold.

IX

DO ANIMALS THINK AND REFLECT?

WHEN we see the animals going about, living their lives in many ways as we live ours, seeking their food, avoiding their enemies, building their nests, digging their holes, laying up stores, migrating, courting, playing, fighting, showing cunning, courage, fear, joy, anger, rivalry, grief, profiting by experience, following their leaders, — when we see all this, I say, what more natural than that we should ascribe to them powers akin to our own, and look upon them as thinking, reasoning, and reflecting. A hasty survey of animal life is sure to lead to this conclusion. An animal is not a clod, nor a block, nor a machine. It is alive and self-directing, it has some sort of psychic life, yet the more I study the subject, the more I am persuaded that with the probable exception of the dog on occasions, and of the apes, animals do not think or reflect in any proper sense of those words. As I have before said, animal life shows in an active and free state that kind of intelligence that pervades and governs the whole organic world, — intelligence that takes no thought of itself. Here, in front of my window, is a black

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raspberry bush. A few weeks ago its branches curved upward, with their ends swinging fully two feet above the ground; now those ends are thrust down through the weeds and are fast rooted to the soil. Did the raspberry bush think, or choose what it should do? Did it reflect and say, Now is the time for me to bend down and thrust my tip into the ground? To all intents and purposes yes, yet there was no voluntary mental process, as in similar acts of our own. We say its nature prompts it to act thus and thus, and that is all the explanation we can give. Or take the case of the pine or the spruce tree that loses its central and leading shoot. When this happens, does the tree start a new bud and then develop a new shoot to take the place of the lost leader? No, a branch from the first ring of branches below, probably the most vigorous of the whorl, is promoted to the leadership. Slowly it rises up, and in two or three years it reaches the upright position and is leading the tree upward. This, I suspect, is just as much an act of conscious intelligence and of reason as is much to which we are so inclined to apply those words in animal life. I suppose it is all foreordained in the economy of the tree, if we could penetrate that economy. It is in this sense that Nature thinks in the animal, and the vegetable, and the mineral worlds. Her thinking is more flexible and adaptive in the vegetable than in the mineral, and more so in the animal

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than in the vegetable, and the most so of all in the mind of man.

The way the wild apple trees and the red thorn trees in the pasture, as described by Thoreau, triumph over the cattle that year after year browse them down, suggests something almost like human tactics. The cropped and bruised tree, not being allowed to shoot upward, spreads more and more laterally, thus pushing its enemies farther and farther away, till, after many years, a shoot starts up from the top of the thorny, knotted cone, and in one season, protected by this *cheval-de-frise*, attains a height beyond the reach of the cattle, and the victory is won. Now the whole push of the large root system goes into the central shoot and the tree is rapidly developed.

This almost looks like a well-laid scheme on the part of the tree to defeat its enemies. But see how inevitable the whole process is. Check the direct flow of a current and it will flow out at the sides; check the side issues and they will push out on their sides, and so on. So it is with the tree or seedling. The more it is cropped, the more it branches and rebranches, pushing out laterally as its vertical growth is checked, till it has surrounded the central stalk on all sides with a dense, thorny hedge. Then as this stalk is no longer cropped, it leads the tree upward. The lateral branches are starved, and in a few years the tree stands with little or no evi-

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dence of the ordeal it has passed through. In like manner the nature of the animals prompts them to the deeds they do, and we think of them as the result of a mental process, because similar acts in ourselves are the result of such a process.

See how the mice begin to press into our buildings as the fall comes on. Do they know winter is coming? In the same way the vegetable world knows it is coming when it prepares for winter, or the insect world when it makes ready, but not as you and I know it. The woodchuck "holes up" in late September; the crows flock and select their rookery about the same time, and the small wood newts or salamanders soon begin to migrate to the marshes. They all know winter is coming, just as much as the tree knows, when in August it forms its new buds for the next year, or as the flower knows that its color and perfume will attract the insects, and no more. The general intelligence of nature settles all these and similar things.

When a bird selects a site for its nest, it seems, on first view, as if it must actually think, reflect, compare, as you and I do when we decide where to place our house. I saw a little chipping sparrow trying to decide between two raspberry bushes. She kept going from one to the other, peering, inspecting, and apparently weighing the advantages of each. I saw a robin in the woodbine on the side of the house trying to decide which particular place was the best site

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for her nest. She hopped to this tangle of shoots and sat down, then to that, she turned around, she re-adjusted herself, she looked about, she worked her feet beneath her, she was slow in making up her mind. Did she make up her mind? Did she think, compare, weigh? I do not believe it. When she found the right conditions, she no doubt felt pleasure and satisfaction, and that settled the question. An inward, instinctive want was met and satisfied by an outward material condition. In the same way the hermit crab goes from shell to shell upon the beach, seeking one to its liking. Sometimes two crabs fall to fighting over a shell that each wants. Can we believe that the hermit crab thinks and reasons? It selects the suitable shell instinctively, and not by an individual act of judgment. Instinct is not always inerrant, though it makes fewer mistakes than reason does. The red squirrel usually knows how to come at the meat in the butternut with the least gnawing, but now and then he makes a mistake and strikes the edge of the kernel, instead of the flat side. The cliff swallow will stick her mud nest under the eaves of a barn where the boards are planed so smooth that the nest sooner or later is bound to fall. She seems to have no judgment in the matter. Her ancestors built upon the face of high cliffs, where the mud adhered more firmly.

A wood thrush began a nest in one of my maples, as usual making the foundation of dry leaves, bits

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of paper, and dry grass. After the third day the site on the branch was bare, the wind having swept away every vestige of the nest. As I passed beneath the tree I saw the thrush standing where the nest had been, apparently in deep thought. A few days afterward I looked again, and the nest was completed. The bird had got ahead of the wind at last. The nesting-instinct had triumphed over the weather.

Take the case of the little yellow warbler when the cowbird drops her egg into its nest — does anything like a process of thought or reflection pass in the bird's mind then? The warbler is much disturbed when she discovers the strange egg, and her mate appears to share her agitation. Then after a time, and after the two have apparently considered the matter together, the mother bird proceeds to bury the egg by building another nest on top of the old one. If another cowbird's egg is dropped in this one, she will proceed to get rid of this in the same way. This all looks very like reflection. But let us consider the matter a moment. This thing between the cowbird and the warbler has been going on for innumerable generations. The yellow warbler seems to be the favorite host of this parasite, and something like a special instinct may have grown up in the warbler with reference to this strange egg. The bird reacts, as the psychologists say, at sight of it, then she proceeds to dispose of it in the way

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above described. *All yellow warblers act in the same manner*, which is the way of instinct. Now if this procedure was the result of an individual thought or calculation on the part of the birds, they would not all do the same thing ; different lines of conduct would be hit upon. How much simpler and easier it would be to throw the egg out — how much more like an act of rational intelligence. So far as I know, no bird does eject this parasitical egg, and no other bird besides the yellow warbler gets rid of it in the way I have described. I have found a deserted phœbe's nest with one egg of the phœbe and one of the cowbird in it.

Some of our wild birds have changed their habits of nesting, coming from the woods and the rocks to the protection of our buildings. The phœbe-bird and the cliff swallow are marked examples. We ascribe the change to the birds' intelligence, but to my mind it shows only their natural adaptiveness. Take the cliff swallow, for instance; it has largely left the cliffs for the eaves of our buildings. How naturally and instinctively this change has come about! In an open farming country insect life is much more varied and abundant than in a wild, unsettled country. This greater food supply naturally attracts the swallows. Then the protecting eaves of the buildings would stimulate their nesting-instincts. The abundance of mud along the highways and about the farm would also no doubt have its effect, and the

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birds would adopt the new sites as a matter of course. Or take the phoebe, which originally built its nest under ledges, and does so still to some extent. It, too, would find a more abundant food supply in the vicinity of farm-buildings and bridges. The protected nesting-sites afforded by sheds and porches would likewise stimulate its nesting-instincts, and attract the bird as we see it attracted each spring.

Nearly everything an animal does is the result of an inborn instinct acted upon by an outward stimulus. The margin wherein intelligent choice plays a part is very small. But it does at times play a part — perceptive intelligence, but not rational intelligence. The insects do many things that look like intelligence, yet how these things differ from human intelligence may be seen in the case of one of our solitary wasps, — the mud-dauber, — which sometimes builds its cell with great labor, then seals it up without laying its egg and storing it with the accustomed spiders. Intelligence never makes that kind of a mistake, but instinct does. Instinct acts more in the invariable way of a machine. Certain of the solitary wasps bring their game — spider, or bug, or grasshopper — and place it just at the entrance of their hole, and then go into their den apparently to see that all is right before they carry it in.

Fabre, the French naturalist, experimented with one of these wasps, as follows: While the wasp was in its den he moved its grasshopper a few inches

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away. The wasp came out, brought it to the opening as before, and went within a second time; again the game was removed, again the wasp came out and brought it back and entered her nest as before. This little comedy was repeated over and over; each time the wasp felt compelled to enter her hole before dragging in the grasshopper. She was like a machine that would work that way and no other. Step must follow step in just such order. Any interruption of the regular method and she must begin over again. This is instinct, and the incident shows how widely it differs from conscious intelligence.

If you have a tame chipmunk, turn him loose in an empty room and give him some nuts. Finding no place to hide them, he will doubtless carry them into a corner and pretend to cover them up. You will see his paws move quickly about them for an instant as if in the act of pulling leaves or mould over them. His machine, too, must work in that way. After the nuts have been laid down, the next thing in order is to cover them, and he makes the motions all in due form. Intelligence would have omitted this useless act.

A canary-bird in its cage will go through all the motions of taking a bath in front of the cup that holds its drinking-water when it can only dip its bill into the liquid. The sight or touch of the water excites it and sets it going, and with now and then a drop thrown from its beak it will keep up the flirting

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and fluttering motion of its tail and wings precisely as if taking a real instead of an imaginary bath.

Attempt to thwart the nesting-instinct in a bird and see how persistent it is, and how blind! One spring a pair of English sparrows tried to build a nest on the plate that upholds the roof of my porch. They were apparently attracted by an opening about an inch wide in the top of the plate, that ran the whole length of it. The pair were busy nearly the whole month of April in carrying nesting-material to various points on that plate. That big crack or opening which was not large enough to admit their bodies seemed to have a powerful fascination for them. They carried straws and weed stalks and filled up one portion of it, and then another and another, till the crack was packed with rubbish from one end of the porch to the other, and the indignant broom of the housekeeper grew tired of sweeping up the litter. The birds could not effect an entrance into the interior of the plate, but they could thrust in their nesting-material, and so they persisted week after week, stimulated by the presence of a cavity beyond their reach. The case is a good illustration of the blind working of instinct.

Animals have keen perceptions, — keener in many respects than our own, — but they form no conceptions, have no powers of comparing one thing with another. They live entirely in and through their senses.

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It is as if the psychic world were divided into two planes, one above the other, — the plane of sense and the plane of spirit. In the plane of sense live the lower animals, only now and then just breaking for a moment into the higher plane. In the world of sense man is immersed also — this is his start and foundation; but he rises into the plane of spirit, and here lives his proper life. He is emancipated from sense in a way that beasts are not.

Thus, I think, the line between animal and human psychology may be pretty clearly drawn. It is not a dead-level line. Instinct is undoubtedly often modified by intelligence, and intelligence is as often guided or prompted by instinct, but one need not hesitate long as to which side of the line any given act of man or beast belongs. When the fox resorts to various tricks to outwit and delay the hound (if he ever consciously does so), he exercises a kind of intelligence, — the lower form which we call cunning, — and he is prompted to this by an instinct of self-preservation. When the birds set up a hue and cry about a hawk or an owl, or boldly attack him, they show intelligence in its simpler form, the intelligence that recognizes its enemies, prompted again by the instinct of self-preservation. When a hawk does not know a man on horseback from a horse, it shows a want of intelligence. When a crow is kept away from a corn-field by a string stretched around it, the fact shows how masterful is its fear and how

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shallow its wit. When a cat or a dog, or a horse or a cow, learns to open a gate or a door, it shows a degree of intelligence — power to imitate, to profit by experience. A machine could not learn to do this. If the animal were to close the door or gate behind it, that would be another step in intelligence. But its direct wants have no relation to the closing of the door, only to the opening of it. To close the door involves an after-thought that an animal is not capable of. A horse will hesitate to go upon thin ice or upon a frail bridge, even though it has never had any experience with thin ice or frail bridges. This, no doubt, is an inherited instinct, which has arisen in its ancestors from their fund of general experience with the world. How much with them has depended upon a secure footing! A pair of house wrens had a nest in my well-curb; when the young were partly grown and heard any one come to the curb, they would set up a clamorous calling for food. When I scratched against the sides of the curb beneath them like some animal trying to climb up, their voices instantly hushed; the instinct of fear promptly overcame the instinct of hunger. Instinct is intelligent, but it is not the same as acquired individual intelligence; it is untaught.

When the nuthatch carries a fragment of a hickory-nut to a tree and wedges it into a crevice in the bark, the bird is not showing an individual act of intelligence: all nuthatches do this; it is a race

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instinct. The act shows intelligence, — that is, it adapts means to an end, — but it is not like human or individual intelligence, which adapts new means to old ends, or old means to new ends, and which springs up on the occasion. Jays and chickadees hold the nut or seed they would peck under the foot, but the nuthatch makes a vise to hold it of the bark of the tree, and one act is just as intelligent as the other; both are the promptings of instinct. But when man makes a vise, or a wedge, or a bootjack, he uses his individual intelligence. When the jay carries away the corn you put out in winter and hides it in old worms' nests and knot-holes and crevices in trees, he is obeying the instinct of all his tribe to pilfer and hide things, — an instinct that plays its part in the economy of nature, as by its means many acorns and chestnuts get planted and large seeds widely disseminated. By this greed of the jay the wingless nuts take flight, oaks are planted amid the pines, and chestnuts amid the hemlocks.

Speaking of nuts reminds me of an incident I read of the deer or white-footed mouse — an incident that throws light on the limitation of animal intelligence. The writer gave the mouse hickory-nuts, which it attempted to carry through a crack between the laths in the kitchen wall. The nuts were too large to go through the crack. The mouse would try to push them through; failing in that, he

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would go through and then try to pull them after him. All night he or his companion seems to have kept up this futile attempt, fumbling and dropping the nut every few minutes. It never occurred to the mouse to gnaw the hole larger, as it would instantly have done had the hole been too small to admit its own body. It could not project its mind thus far; it could not get out of itself sufficiently to regard the nut in its relation to the hole, and it is doubtful if any four-footed animal is capable of that degree of reflection and comparison. Nothing in its own life or in the life of its ancestors had prepared it to meet that kind of a difficulty with nuts. And yet the writer who made the above observation says that when confined in a box, the sides of which are of unequal thickness, the deer mouse, on attempting to gnaw out, almost invariably attacks the thinnest side. How does he know which is the thinnest side? Probably by a delicate and trained sense of feeling or hearing. In gnawing through obstructions from within, or from without, he and his kind have had ample experience.

Now when we come to insects, we find that the above inferences do not hold. It has been observed that when a solitary wasp finds its hole in the ground too small to admit the spider or other insect which it has brought, it falls to and enlarges it. In this and in other respects certain insects seem to take the step of reason that quadrupeds are incapable of.

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Lloyd Morgan relates at some length the experiments he tried with his fox terrier, Tony, seeking to teach him how to bring a stick through a fence with vertical palings. The spaces would allow the dog to pass through, but the palings caught the ends of the stick which the dog carried in his mouth. When his master encouraged him, he pushed and struggled vigorously. Not succeeding, he went back, lay down, and began gnawing the stick. Then he tried again, and stuck as before, but by a chance movement of his head to one side finally got the stick through. His master patted him approvingly and sent him for the stick again. Again he seized it by the middle, and of course brought up against the palings. After some struggles he dropped it and came through without it. Then, encouraged by his master, he put his head through, seized the stick, and tried to pull it through, dancing up and down in his endeavors. Time after time and day after day the experiment was repeated with practically the same results. The dog never mastered the problem. He could not see the relation of that stick to the opening in the fence. At one time he worked and tugged three minutes trying to pull the stick through. Of course, if he had had any mental conception of the problem or had thought about it at all, a single trial would have convinced him as well as would a dozen trials. Mr. Morgan tried the experiment with other dogs with like result. When

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they did get the stick through, it was always by chance.

It has never been necessary that the dog or his ancestors should know how to fetch long sticks through a narrow opening in a fence. Hence he does not know the trick of it. But we have a little bird that knows the trick. The house wren will carry a twig three inches long through a hole of half that diameter. She knows how to manage it because the wren tribe have handled twigs so long in building their nests that this knowledge has become a family instinct.

What we call the intelligence of animals is limited for the most part to sense perception and sense memory. We teach them certain things, train them to do tricks quite beyond the range of their natural intelligence, not because we enlighten their minds or develop their reason, but mainly by the force of habit. Through repetition the act becomes automatic. Who ever saw a trained animal, unless it be the elephant, do anything that betrayed the least spark of conscious intelligence? The trained pig, or the trained dog, or the trained lion does its "stunt" precisely as a machine would do it — without any more appreciation of what it is doing. The trainer and public performer find that things must always be done in the same fixed order; any change, anything unusual, any strange sound, light, color, or movement, and trouble at once ensues.

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I read of a beaver that cut down a tree which was held in such a way that it did not fall, but simply dropped down the height of the stump. The beaver cut it off again; again it dropped and refused to fall; he cut it off a third and a fourth time: still the tree stood. Then he gave it up. Now, so far as I can see, the only independent intelligence the animal showed was when it ceased to cut off the tree. Had it been a complete automaton, it would have gone on cutting — would it not? — till it made stove-wood of the whole tree. It was confronted by a new problem, and after a while it took the hint. Of course it did not understand what was the matter, as you and I would have, but it evidently concluded that something was wrong. Was this of itself an act of intelligence? Though it may be that its ceasing to cut off the tree was simply the result of discouragement, and involved no mental conclusion at all. It is a new problem, a new condition, that tests an animal's intelligence. How long it takes a caged bird or beast to learn that it cannot escape! What a man would see at a glance it takes weeks or months to pound into the captive bird, or squirrel, or coon. When the prisoner ceases to struggle, it is probably not because it has at last come to understand the situation, but because it is discouraged. It is checked, but not enlightened.

Even so careful an observer as Gilbert White credits the swallow with an act of judgment to

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which it is not entitled. He says that in order that the mud nest may not advance too rapidly and so fall of its own weight, the bird works at it only in the morning, and plays and feeds the rest of the day, thus giving the mud a chance to harden. Had not the genial parson observed that this is the practice of all birds during nest-building—that they work in the early morning hours and feed and amuse themselves the rest of the day? In the case of the mud-builders, this interim of course gives the mud a chance to harden, but are we justified in crediting them with this forethought?

Such skill and intelligence as a bird seems to display in the building of its nest, and yet at times such stupidity! I have known a phœbe-bird to start four nests at once, and work more or less upon all of them. She had deserted the ancestral sites under the shelving rocks and come to a new porch, upon the plate of which she started her four nests. She blundered because her race had had little or no experience with porches. There were four or more places upon the plate just alike, and whichever one of these she chanced to strike with her loaded beak she regarded as the right one. Her instinct served her up to a certain point, but it did not enable her to discriminate between those rafters. Where a little original intelligence should have come into play she was deficient. Her progenitors had built under rocks where there was little chance

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for mistakes of this sort, and they had learned through ages of experience to blend the nest with its surroundings, by the use of moss, the better to conceal it. My phœbe brought her moss to the new timbers of the porch, where it had precisely the opposite effect to what it had under the gray mossy rocks.

I was amused at the case of a robin that recently came to my knowledge. The bird built its nest in the south end of a rude shed that covered a table at a railroad terminus upon which a locomotive was frequently turned. When her end of the shed was turned to the north she built another nest in the temporary south end, and as the reversal of the shed ends continued from day to day, she soon had two nests with two sets of eggs. When I last heard from her, she was consistently sitting on that particular nest which happened to be for the time being in the end of the shed facing toward the south. The bewildered bird evidently had had no experience with the tricks of turn-tables!

An intelligent man once told me that crabs could reason, and this was his proof: In hunting for crabs in shallow water, he found one that had just cast its shell, but the crab put up just as brave a fight as ever, though of course it was powerless to inflict any pain; as soon as the creature found that its bluff game did not work, it offered no further resistance. Now I should as soon say a wasp rea-

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soned because a stingless drone, or male, when you capture him, will make all the motions with its body, curving and thrusting, that its sting-equipped fellows do. This action is from an inherited instinct, and is purely automatic. The wasp is not putting up a bluff game; it is really trying to sting you, but has not the weapon. The shell-less crab quickly reacts at your approach, as is its nature to do, and then quickly ceases its defense because in its enfeebled condition the impulse of defense is feeble also. Its surrender was on physiological, not upon rational grounds.

Thus do we without thinking impute the higher faculties to even the lowest forms of animal life. Much in our own lives is purely automatic — the quick reaction to appropriate stimuli, as when we ward off a blow, or dodge a missile, or make ourselves agreeable to the opposite sex; and much also is inherited or unconsciously imitative.

Because man, then, is half animal, shall we say that the animal is half man? This seems to be the logic of some people. The animal man, while retaining much of his animality, has evolved from it higher faculties and attributes, while our four-footed kindred have not thus progressed.

Man is undoubtedly of animal origin, but his rise occurred when the principle of variation was much more active, when the forms and forces of nature were much more youthful and plastic, when

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the seething and fermenting of the vital fluids were at a high pitch in the far past, and it was high tide with the creative impulse. The world is aging, and, no doubt, the power of initiative in Nature is becoming less and less. I think it safe to say that ~~the~~ worm no longer aspires to be man.

X

A PINCH OF SALT

PROBABLY I have become unusually cautious of late about accepting offhand all I read in print on subjects of natural history. I take much of it with a liberal pinch of salt. Newspaper reading tends to make one cautious — and who does not read newspapers in these days? One of my critics says, apropos of certain recent strictures of mine upon some current nature writers, that I discredit whatever I have not myself seen; that I belong to that class of observers “whose view-point is narrowed to the limit of their own personal experience.” This were a grievous fault if it were true, so much we have to take upon trust in natural history as well as in other history, and in life in general. “Mr. Burroughs might have remembered,” says another critic discussing the same subject, “that nobody has seen quite so many things as everybody.” How true! If I have ever been guilty of denying the truth of what everybody has seen, my critic has just ground for complaint. I was conscious, in the paper referred to,¹ of denying only the truth of certain

¹ *Atlantic Monthly*, March, 1903.

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things that one man alone had reported having seen, — things so at variance not only with my own observations, but with those of all other observers and with the fundamental principles of animal psychology, that my “will to believe,” always easy to move, balked and refused to take a step.

In matters of belief in any field, it is certain that the scientific method, the method of proof, is not of equal favor with all minds. Some persons believe what they can or must, others what they would. One person accepts what agrees with his reason and experience, another what is agreeable to his or her fancy. The grounds of probability count much with me; the tone and quality of the witness count for much. Does he ring true? Is his eye single? Does he see out of the back of his head? — that is, does he see on more than one side of a thing? Is he in love with the truth, or with the strange, the bizarre? Last of all, my own experience comes in to correct or to modify the observations of others. If what you report is antecedently improbable, I shall want concrete proof before accepting it, and I shall cross-question your witness sharply. If you tell me you have seen apples and acorns, or pears and plums, growing upon the same tree, I shall discredit you. The thing has never been known and is contrary to nature. But if you tell me you have seen a peach tree bearing nectarines, or have known a nectarine-stone to produce a peach tree, I shall

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still want to cross-question you sharply, but I may believe you. Such things have happened. Or if you tell me that you have seen an old doe with horns, or a hen with spurs, or a male bird incubating and singing on the nest, unusual as the last occurrence is, I shall not dispute you. I will concede that you may have seen a white crow or a white blackbird or a white robin, or a black chipmunk or a black red squirrel, and many other departures from the usual in animal life; but I cannot share the conviction of the man who told me he had seen a red squirrel curing rye before storing it up in its den, or of the writer who believes the fox will ride upon the back of a sheep to escape the hound, or of another writer that he has seen the blue heron chumming for fish. Even if you aver that you have seen a woodpecker running down the trunk of a tree as well as up, I shall be sure you have not seen correctly. It is the nuthatch and not the woodpecker that hops up and down and around the trees. It is easy to transcend any man's experience; not so easy to transcend his reason. "Nobody has seen so many things as everybody," yet a dozen men cannot see any farther than one, and the truth is not often a matter of majorities. If you tell me any incident in the life of bird or beast that implies the possession of what we mean by reason, I shall be very skeptical.

Am I guilty, then, as has been charged, of pre-

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ferring the deductive method of reasoning to the more modern and more scientific inductive method? But I doubt if the inductive method would avail one in trying to prove that the old cow really jumped over the moon. We do deny certain things upon general principles, and affirm others. I do not believe that a rooster ever laid an egg, or that a male tiger ever gave milk. If your alleged fact contradicts fundamental principles, I shall beware of it; if it contradicts universal experience, I shall probe it thoroughly. A college professor wrote me that he had seen a crow blackbird catch a small fish and fly away with it in its beak. Now I have never seen anything of the kind, but I know of no principle upon which I should feel disposed to question the truth of such an assertion. I have myself seen a crow blackbird kill an English sparrow. Both proceedings I think are very unusual, but neither is antecedently improbable. If the professor had said that he saw the blackbird dive head first into the water for the fish, after the manner of the kingfisher, I should have been very skeptical. He only saw the bird rise up from the edge of the water with the wriggling fish in its mouth. It had doubtless seized it in shallow water near the shore. But I should discredit upon general principles the statement of the woman who related with much detail how she and her whole family had seen a pair "of small brown birds" carry their half-fledged

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young from their nest in a low bush, where there was danger from cats, to a new nest which they had just finished in the top of a near-by tree! Could any person who knows the birds credit such a tale? The bank-teller throws out the counterfeit coin or bill because his practiced eye and touch detect the fraud at once. On similar grounds the experienced observer rejects all such stories as the above. Darwin quotes an authority for the statement that our ruffed grouse makes its drumming sound by striking its wings together over its back. A recent writer says the sound is not made with the wings at all, but is made with the voice, just as a rooster crows. Every woodsman knows that neither statement is true, and he knows it, not on general principles, but from experience — he has seen the grouse drum.

Birds that are not flycatchers sometimes take insects in the air; they do it clumsily, but they get the bug. On the other hand, flycatchers sometimes eat fruit. I have seen the kingbird carry off raspberries. All such facts are matters of observation. In the search for truth we employ both the deductive and the inductive methods; we deduce principles from facts, and we test alleged facts by principles.

The other day an intelligent woman told me this about a canary-bird: The bird had a nest with young in the corner of her cage; near by were some other birds in a cage — I forget what they were; they had a full view of all the domestic affairs of the

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canary. This publicity she evidently did not like, for she tore out of the paper that covered the bottom of her cage a piece as large as one's hand and wove it into the wires so as to make a screen against her inquisitive neighbors. My informant evidently believed this story. It was agreeable to her fancies and feelings. But see the difficulties in the way. How could the bird with its beak tear out a broad piece of paper? then, how could it weave it into the wires of its cage? Furthermore, the family of birds to which the canary belongs are not weavers; they build cup-shaped nests, and they have had no use for screens or covers, and they never have made them. Just what was the truth about the matter I cannot say, but if we know anything about animal psychology, we know that was not the truth. It is always risky to attribute to an animal any act its ancestors could not have performed.

Again, things are reported as facts that are not so much contrary to reason as contrary to all experience, and with these, too, I have my difficulties. A recent writer upon our wild life says he has discovered that the cowbird watches over its young and assists the foster-parents in providing food for them — an observation so contrary to all that we know of parasitical birds, both at home and abroad, that no real observer can credit the statement. Our cowbird has been under observation for a hundred years or more; every dweller in the coun-

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try must see one or more young cowbirds being fed by their foster-parents every season, yet no competent observer has ever reported any care of the young bird by its real parent. If this were true, it would make the cowbird only half parasitical — an unheard-of phenomenon.

The same writer tells this incident about a grouse that had a nest near his cabin. One morning he heard a strange cry in the direction of the nest, and taking the path that led to it, he met the grouse running toward him with one wing pressed close to her side, and fighting off two robber crows with the other. Under the closed wing the grouse was carrying an egg, which she had managed to save from the ruin of her nest. The bird was coming to the hermit for succor. Now, am I skeptical about such a story, put down in apparent good faith in a book of natural history as a real occurrence, because I have never seen the like? No; I am skeptical because the incident is so contrary to all that we know about grouse and all other wild birds. Our belief in nearly all matters takes the line of least resistance, and it is easier for me to believe that the writer deceived himself, than that such a thing ever happened. In the first place, a grouse could not pick up an egg with her wing when crows were trying to rob her, and, in the second place, she would not think far enough to do it if she had the power. What was she going to do with the egg? Bring it to the hermit for

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his breakfast? This last supposition is just as reasonable as any part of the story. A grouse will not readily leave her unfledged young, but she will leave her eggs when disturbed by man or beast with apparent unconcern.

It is the rarest thing in the world that real observers see any of these startling and exceptional things in nature. Thoreau saw none. White saw none. Charles St. John saw none. John Muir reports none, Audubon none. It is always your untrained observer that has his posser, his shower of frogs or lizards, or his hoop snakes, and the like. The impossible things that country people see or hear of would make a book of wonders. In some places fishermen believe that the loon carries its egg under its wing till it hatches, and one would say that they are in a position to know. So they are. But opportunity is only half the problem; the verifying mind is the other half. One of our writers of popular nature books relates this curious incident of "animal surgery" among wild ducks. He discovered two eider ducks swimming about a fresh-water pond and acting queerly, "dipping their heads under water and keeping them there for a minute or more at a time." He later discovered that the ducks had large mussels attached to their tongues, and that they were trying to get rid of them by drowning them. The birds had discovered that the salt-water mussel cannot live in fresh water. Now am I to

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accept this story without question because I find it printed in a book? In the first place, is it not most remarkable that if the ducks had discovered that the bivalves could not live in fresh water, they should not also have discovered that they could not live in the air? In fact, that they would die as soon in the air as in the fresh water?¹ See how much trouble the ducks could have saved themselves by going and sitting quietly upon the beach, or putting their heads under their wings and going to sleep on the wave. Oysters are often laid down in fresh water to "fatten" before being sent to market, and probably mussels would thrive for a short time in fresh water equally well. In the second place, a duck's tongue is a very short and stiff affair, and is fixed in the lower mandible as in a trough. Ducks do not protrude the tongue when they feed; they cannot protrude it; and if a duck can crush a mussel-shell with its beak, what better position could it have the bivalve in than fast to the tongue between the upper and the lower mandible? The story is certainly a very "fishy" one. In all such cases the mind follows the line of least resistance. If the ducks were deliberately holding their bills under water, it is easier to believe that they did it because they thereby found some relief from pain, than that they knew the bivalves would let go their hold

¹ I have tried the experiment on two ordinary clams, and they both died on the third day.

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scorer in fresh water than in salt or than in the air. A duck's mouth held open and the tongue pinched by a shell-fish would doubtless soon be in a feverish and abnormal condition, which cool water would tend to alleviate. One is unable to see how the ducks could have acquired the kind of human experimental knowledge attributed to them. A person might learn such a secret, but surely not a duck. In discovering and in eluding its enemies, and in many other ways, the duck's wits are very sharp, but to attribute to them a knowledge of the virtues of fresh water over salt in a certain unusual emergency — an emergency that could not have occurred to the race of ducks, much less to individuals often enough for a special instinct to have been developed to meet it — is to make them entirely human.

The whole idea of animal surgery which the incident implies — such as mending broken legs with clay, salving wounds with pitch, or resorting to bandages or amputations — is preposterous. Sick or wounded animals will often seek relief from pain by taking to the water or to the mud, or maybe to the snow, just as cows will seek the pond or the bushes to escape the heat and the flies, and that is about the extent of their surgery. The dog licks his wound; it no doubt soothes and relieves it. The cow licks her calf; she licks him into shape; it is her instinct to do so. That tongue of hers is a currycomb, plus warmth and moisture and flexi-

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bility. The cat always carries her kittens by the back of the neck; it is her best way to carry them, though I do not suppose this act is the result of experiment on her part.

A chimney swift has taken up her abode in my study chimney. At intervals, day or night, when she hears me in the room, she makes a sudden flapping and drumming sound with her wings to scare me away. It is a very pretty little trick and quite amusing. If you appear above the opening of the top of a chimney where a swift is sitting on her nest, she will try to drum you away in the same manner. I do not suppose there is any thought or calculation in her behavior, any more than there is in her nest-building, or any other of her instinctive doings. It is probably as much a reflex act as that of a bird when she turns her eggs, or feigns lameness or paralysis, to lure you away from her nest, or as the "playing possum" of a rose-bug or potato-bug when it is disturbed.

One of the writers referred to above relates with much detail this astonishing thing of the Canada lynx: He saw a pack of them trailing their game — a hare — through the winter woods, not only hunting in concert, but tracking their quarry. Now any candid and informed reader will balk at this story, for two reasons: (1) the cat tribe do not hunt by scent, but by sight, — they stalk or waylay their game; (2) they hunt singly, they are all solitary in their habits, they are probably the most unsocial of the carnivora,

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—they prowl, they listen, they bide their time. Wolves often hunt in packs. I have no evidence that foxes do, and if the cats ever do, it is a most extraordinary departure. A statement of such an exceptional occurrence should always put one on his guard. In the same story the lynx is represented as making curious antics in the air to excite the curiosity of a band of caribou, and thus lure one of them to its death at the teeth and claws of the waiting hidden pack. This also is so uncatlike a proceeding that no woodsman could ever credit it. Hunters on the plains sometimes “flag” deer and antelope, and I have seen even a loon drawn very near to a bather in the water who was waving a small red flag. But none of our wild creatures use lures, or decoys, or disguises. This would involve a process of reasoning quite beyond them.

Many instances have been recorded of animals seeking the protection of man when pursued by their deadly enemies. I heard of a rat which, when hunted by a weasel, rushed into a room where a man was sleeping, and took refuge in the bed at his feet. I heard Mr. Thompson Seton tell of a young pronghorn buck that was vanquished by a rival, and so hotly pursued by its antagonist that it sought shelter amid his horses and wagons. On another occasion Mr. Seton said a jack rabbit pursued by a weasel upon the snow sought safety under his sled. In all such cases, if the frightened animal really

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rushed to man for protection, that act would show a degree of reason. The animal must think, and weigh the *pros* and *cons*. But I am convinced that the truth about such cases is this: The greater fear drives out the lesser fear; the animal loses its head, and becomes oblivious to everything but the enemy that is pursuing it. The rat was so terrified at the demon of a weasel that it had but one impulse, and that was to hide somewhere. Doubtless had the bed been empty, it would have taken refuge there just the same. How could an animal know that a man will protect it on special occasions, when ordinarily it has exactly the opposite feeling? A deer hotly pursued by a hound might rush into the barn-yard or into the open door of the barn in sheer desperation of uncontrollable terror. Then we should say the creature knew the farmer would protect it, and every woman who read the incident, and half the men, would believe that that thought was in the deer's mind. When the hunted deer rushes into the lake or pond, it does so, of course, with a view to escape its pursuers, and wherever it seeks refuge this is its sole purpose. I can easily fancy a bird pursued by a hawk darting into an open door or window, not with the thought that the inmates of the house will protect it, but in a panic of absolute terror. Its fear is then centred upon something behind it, not in front of it.

When an animal does something necessary to its

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self-preservation, or to the continuance of its species, it probably does not think about it as a person would, any more than the plant or tree thinks about the light when it bends toward it, or about the moisture when it sends down its tap-root. Touch the tail of a porcupine ever so lightly, and it springs up like a trap and your hand is stuck with quills. I do not suppose there is any more thinking about the act, or any more conscious exercise of will-power, than there is in a trap. An outward stimulus is applied and the reaction is quick. Does not man wink, and dodge, and sneeze, and laugh, and cry, and blush, and fall in love, and do many other things without thought or will? I do not suppose the birds think about migrating, as man does when he migrates; they simply obey an inborn impulse to move south or north, as the case may be. They do not think about the great lights upon the coast that blaze out with a fatal fascination in their midnight paths. If they had independent powers of thought, they would avoid them. But the lighthouse is comparatively a new thing in the life of birds, and instinct has not yet taught them to avoid it. To adapt means to an end is an act of intelligence, but that intelligence may be inborn and instinctive as in the animals, or it may be acquired and therefore rational as in man.

"Surely," said a woman to me, "when a cat sits watching at a mouse-hole, she has some image in her mind of the mouse in its hole?" Not in any such

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sense as we have when we think of the same subject. The cat has either seen the mouse go into the hole, or else she smells him; she knows he is there through her senses, and she reacts to that impression. Her instinct prompts her to hunt and to catch mice; she does n't need to think about them as we do about the game we hunt; Nature has done that for her in the shape of an inborn impulse that is awakened by the sight or smell of mice. We have no ready way to describe her act as she sits intently by the hole but to say, "The cat thinks there is a mouse there," while she is not thinking at all, but simply watching, prompted to it by her inborn instinct for mice.

The cow's mouth will water at the sight of her food when she is hungry. Is she thinking about it? No more than you are when your mouth waters as your full dinner-plate is set down before you. Certain desires and appetites are aroused through sight and smell without any mental cognition. The sexual relations of the animals also illustrate this fact.

We know that the animals do not think in any proper sense as we do, or have concepts and ideas, because they have no language. To be sure, a deaf mute thinks without language because a human being has the intelligence which language implies, or which was begotten in his ancestors by its use through long ages. Not so with the lower animals. They are like very young children in this respect; they have impressions, perceptions, emotions, but

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not ideas. The child perceives things, discriminates things, knows its mother from a stranger, is angry, or glad, or afraid, long before it has any language or any proper concepts. Animals know only through their senses, and this "knowledge is restricted to things present in time and space." Reflection, or a return upon themselves in thought, of this they are not capable. Their only language consists of various cries and calls, expressions of pain, alarm, joy, love, anger. They communicate with one another, and come to share one another's mental or emotional states, through these cries and calls. A dog barks in various tones and keys, each of which expresses a different feeling in the dog. I can always tell when my dog is barking at a snake; there is something peculiar in the tone. The hunter knows when his hound has driven the fox to hole by a change in his baying. The lowing and bellowing of horned cattle are expressions of several different things. The crow has many caws, that no doubt convey various meanings. The cries of alarm and distress of the birds are understood by all the wild creatures that hear them; a feeling of alarm is conveyed to them—an emotion, not an idea.

How could a crow tell his fellows of some future event, or of some experience of the day? How could he tell him this thing is dangerous, this is harmless, save by his actions in the presence of those things? Or how tell of a newly found food supply save by

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flying eagerly to it? A fox or a wolf could warn its fellow of the danger of poisoned meat by showing alarm in the presence of the meat. Such meat would no doubt have a peculiar odor to the keen scent of the fox or the wolf. Animals that live in communities, such as bees and beavers, coöperate with each other without language, because they form a sort of organic unity, and what one feels all the others feel. One spirit, one purpose, fills the community.

It is said on good authority that prairie-dogs will not permit weeds or tall grass to grow about their burrows, as these afford cover for coyotes and other enemies to stalk them. If they cannot remove these screens, they will leave the place. And yet they will sometimes allow a weed such as the Norse nettle or the Mexican poppy to grow on the mound at the mouth of the den where it will afford shade and not obstruct the view. At first thought this conduct may look like a matter of calculation and forethought, but it is doubtless the result of an instinct that has been developed in the tribe by the struggle for existence, and with any given rodent is quite independent of experience. It is an inherited fear of every weed or tuft of grass that might conceal an enemy.

I am told that prairie wolves will dig up and eat meat that has been poisoned and then buried, when they will not touch it if left on the surface. In such a case the ranchmen think the wolf has been out-

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witted; but the truth probably is that there was no calculation in the matter; the soil drew out or dulled the smell of the poison and of the man's hand, and so allayed the wolf's suspicions.

I suppose that when an animal practices deception, as when a bird feigns lameness or a broken wing to decoy you away from her nest or her young, it is quite unconscious of the act. It takes no thought about the matter. In trying to call a hen to his side, a rooster will often make believe he has food in his beak, when the pretended grain or insect may be only a pebble or a bit of stick. He picks it up and then drops it in sight of the hen, and calls her in his most persuasive manner. I do not suppose that in such cases the rooster is conscious of the fraud he is practicing. His instinct, under such circumstances, is to pick up food and call the attention of the hen to it, and when no food is present, he instinctively picks up a pebble or a stick. His main purpose is to get the hen near him, and not to feed her. When he is intent only on feeding her, he never offers her a stone instead of bread.

We have only to think of the animals as habitually in a condition analogous to, or identical with, the unthinking and involuntary character of much of our own lives. They are creatures of routine. They are wholly immersed in the unconscious, involuntary nature out of which we rise, and above which our higher lives go on.

XI

THE LITERARY TREATMENT OF NATURE

THE literary treatment of natural history themes is, of course, quite different from the scientific treatment, and should be so. The former, compared with the latter, is like free-hand drawing compared with mechanical drawing. Literature aims to give us the truth in a way to touch our emotions, and in some degree to satisfy the enjoyment we have in the living reality. The literary artist is just as much in love with the fact as is his scientific brother, only he makes a different use of the fact, and his interest in it is often of a non-scientific character. His method is synthetic rather than analytic. He deals in general, and not in technical truths, — truths that he arrives at in the fields and woods, and not in the laboratory.

The essay-naturalist observes and admires ; the scientific naturalist collects. One brings home a bouquet from the woods ; the other, specimens for his herbarium. The former would enlist your sympathies and arouse your enthusiasm ; the latter would add to your store of exact knowledge. The

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one is just as shy of over-coloring or falsifying his facts as the other, only he gives more than facts, — he gives impressions and analogies, and, as far as possible, shows you the live bird on the bough.

The literary and the scientific treatment of the dog, for instance, will differ widely, not to say radically, but they will not differ in one being true and the other false. Each will be true in its own way. One will be suggestive and the other exact; one will be strictly objective, but literature is always more or less subjective. Literature aims to invest its subject with a human interest, and to this end stirs our sympathies and emotions. Pure science aims to convince the reason and the understanding alone. Note Maeterlinck's treatment of the dog in a late magazine article, probably the best thing on our four-footed comrade that English literature has to show. It gives one pleasure, not because it is all true as science is true, but because it is so tender, human, and sympathetic, without being false to the essential dog nature; it does not make the dog *do* impossible things. It is not natural history, it is literature; it is not a record of observations upon the manners and habits of the dog, but reflections upon him and his relations to man, and upon the many problems, from the human point of view, that the dog must master in a brief time: the distinctions he must figure out, the mistakes he must avoid, the riddles of life he must read in his dumb dog way. Of course, as

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a matter of fact, the dog is not compelled "in less than five or six weeks to get into his mind, taking shape within it, an image and a satisfactory conception of the universe." No, nor in five or six years. Strictly speaking, he is not capable of conceptions at all, but only of sense impressions; his sure guide is instinct — not blundering reason. The dog starts with a fund of knowledge, which man acquires slowly and painfully. But all this does not trouble one in reading of Maeterlinck's dog. Our interest is awakened, and our sympathies are moved, by seeing the world presented to the dog as it presents itself to us, or by putting ourselves in the dog's place. It is not false natural history, it is a fund of true human sentiment awakened by the contemplation of the dog's life and character.

Maeterlinck does not ascribe human powers and capacities to his dumb friend, the dog; he has no incredible tales of its sagacity and wit to relate; it is only an ordinary bull pup that he describes, but he makes us love it, and, through it, all other dogs, by his loving analysis of its trials and tribulations, and its devotion to its god, man. In like manner, in John Muir's story of his dog Stickeen, — a story to go with "Rab and his Friends," — our credulity is not once challenged. Our sympathies are deeply moved because our reason is not in the least outraged. It is true that Muir makes his dog act like a human being under the press of great danger; but

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the action is not the kind that involves reason; it only implies sense perception, and the instinct of self-preservation. Stickeen does as his master bids him, and he is human only in the human emotions of fear, despair, joy, that he shows.

In Mr. Egerton Young's book, called "My Dogs of the Northland," I find much that is interesting and several vivid dog portraits, but Mr. Young humanizes his dogs to a greater extent than does either Muir or Maeterlinck. For instance, he makes his dog Jack take special delight in teasing the Indian servant girl by walking or lying upon her kitchen floor when she had just cleaned it, all in revenge for the slights the girl had put upon him; and he gives several instances of the conduct of the dog which he thus interprets. Now one can believe almost anything of dogs in the way of wit about their food, their safety, and the like, but one cannot make them so entirely human as deliberately to plan and execute the kind of revenge here imputed to Jack. No animal could appreciate a woman's pride in a clean kitchen floor, or see any relation between the tracks which he makes upon the floor and her state of feeling toward himself. Mr. Young's facts are doubtless all right; it is his interpretation of them that is wrong.

It is perfectly legitimate for the animal story writer to put himself inside the animal he wishes to portray, and tell how life and the world look from

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that point of view; but he must always be true to the facts of the case, and to the limited intelligence for which he speaks.

In the humanization of the animals, and of the facts of natural history which is supposed to be the province of literature in this field, we must recognize certain limits. Your facts are sufficiently humanized the moment they become interesting, and they become interesting the moment you relate them in any way to our lives, or make them suggestive of what we know to be true in other fields and in our own experience. Thoreau made his battle of the ants interesting because he made it illustrate all the human traits of courage, fortitude, heroism, self-sacrifice. Burns's mouse at once strikes a sympathetic chord in us without ceasing to be a mouse; we see ourselves in it. To attribute human motives and faculties to the animals is to caricature them; but to put us in such relation with them that we feel their kinship, that we see their lives embosomed in the same iron necessity as our own, that we see in their minds a humbler manifestation of the same psychic power and intelligence that culminates and is conscious of itself in man, — that, I take it, is the true humanization.

We like to see ourselves in the nature around us. We want in some way to translate these facts and laws of outward nature into our own experiences; to relate our observations of bird or beast to our

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own lives. Unless they beget some human emotion in me, — the emotion of the beautiful, the sublime, — or appeal to my sense of the fit, the permanent, — unless what you learn in the fields and the woods corresponds in some way with what I know of my fellows, I shall not long be deeply interested in it. I do not want the animals humanized in any other sense. They all have human traits and ways; let those be brought out — their mirth, their joy, their curiosity, their cunning, their thrift, their relations, their wars, their loves — and all the springs of their actions laid bare as far as possible; but I do not expect my natural history to back up the Ten Commandments, or to be an illustration of the value of training-schools and kindergartens, or to afford a commentary upon the vanity of human wishes. Humanize your facts to the extent of making them interesting, if you have the art to do it, but leave the dog a dog, and the straddle-bug a straddle-bug.

Interpretation is a favorite word with some recent nature writers. It is claimed for the literary naturalist that he interprets natural history. The ways and doings of the wild creatures are exaggerated and misread under the plea of interpretation. Now, if by interpretation we mean an answer to the question, "What does this mean?" or, "What is the exact truth about it?" then there is but one interpretation of nature, and that is the scientific. What is the meaning of the fossils in the rocks? or

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of the carving and sculpturing of the landscape? or of a thousand and one other things in the organic and inorganic world about us? Science alone can answer. But if we mean by interpretation an answer to the inquiry, "What does this scene or incident suggest to you? how do you feel about it?" then we come to what is called the literary or poetic interpretation of nature, which, strictly speaking, is no interpretation of nature at all, but an interpretation of the writer or the poet himself. The poet or the essayist tells what the bird, or the tree, or the cloud means to him. It is himself, therefore, that is being interpreted. What do Ruskin's writings upon nature interpret? They interpret Ruskin — his wealth of moral and ethical ideas, and his wonderful imagination. Richard Jefferies tells us how the flower, or the bird, or the cloud is related to his subjective life and experience. It means this or that to him; it may mean something entirely different to another, because he may be bound to it by a different tie of association. The poet fills the lap of Earth with treasures not her own — the riches of his own spirit; science reveals the treasures that are her own, and arranges and appraises them.

Strictly speaking, there is not much in natural history that needs interpreting. We explain a fact, we interpret an oracle; we explain the action and relation of physical laws and forces, we interpret,

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as well as we can, the geologic record. Darwin sought to explain the origin of species, and to interpret many palæontological phenomena. We account for animal behavior on rational grounds of animal psychology; there is little to interpret. Natural history is not a cryptograph to be deciphered, it is a series of facts and incidents to be observed and recorded. If two wild animals, such as the beaver and the otter, are deadly enemies, there is good reason for it; and when we have found that reason, we have got hold of a fact in natural history. The robins are at enmity with the jays and the crow blackbirds and the cuckoos in the spring, and the reason is, these birds eat the robins' eggs. When we seek to interpret the actions of the animals, we are, I must repeat, in danger of running into all kinds of anthropomorphic absurdities, by reading their lives in terms of our own thinking and consciousness.

A man sees a flock of crows in a tree in a state of commotion; now they all caw, then only one master voice is heard, presently two or three crows fall upon one of their number and fell him to the ground. The spectator examines the victim and finds him dead, with his eyes pecked out. He interprets what he has seen as a court of justice; the crows were trying a criminal, and, having found him guilty, they proceeded to execute him. The curious instinct which often prompts animals to fall

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upon and destroy a member of the flock that is sick, or hurt, or blind, is difficult of explanation, but we may be quite sure that, whatever the reason is, the act is not the outcome of a judicial proceeding in which judge and jury and executioner all play their proper part. Wild crows will chase and maltreat a tame crow whenever they get a chance, just why, it would be hard to say. But the tame crow has evidently lost caste among them. I have what I consider good proof that a number of skunks that were wintering together in their den in the ground fell upon and killed and then partly devoured one of their number that had lost a foot in a trap.

Another man sees a fox lead a hound over a long railroad trestle, when the hound is caught and killed by a passing train. He interprets the fact as a cunning trick on the part of the fox to destroy his enemy! A captive fox, held to his kennel by a long chain, was seen to pick up an ear of corn that had fallen from a passing load, chew it up, scattering the kernels about, and then retire into his kennel. Presently a fat hen, attracted by the corn, approached the hidden fox, whereupon he rushed out and seized her. This was a shrewd trick on the part of the fox to capture a hen for his dinner! In this, and in the foregoing cases, the observer supplies something from his own mind. That is what he or she would do under like conditions. True, a fox does not eat corn; but an idle one, tied

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by a chain, might bite the kernels from an ear in a mere spirit of mischief and restlessness, as a dog or puppy might, and drop them upon the ground; a hen would very likely be attracted by them, when the fox would be quick to see his chance.

Some of the older entomologists believed that in a colony of ants and of bees the members recognized one another by means of some secret sign or password. In all cases a stranger from another colony is instantly detected, and a home member as instantly known. This sign or password, says Burmeister, as quoted by Lubbock, "serves to prevent any strange bee from entering into the same hive without being immediately detected and killed. It, however, sometimes happens that several hives have the same signs, when their several members rob each other with impunity. In these cases the bees whose hives suffer most alter their signs, and then can immediately detect their enemy." The same thing was thought to be true of a colony of ants. Others held that the bees and the ants knew one another individually, as men of the same town do! Would not any serious student of nature in our day know in advance of experiment that all this was childish and absurd? Lubbock showed by numerous experiments that bees and ants did not recognize their friends or their enemies by either of these methods. Just how they did do it he could not clearly settle, though it seems as if they were

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guided more by the sense of smell than by anything else. Maeterlinck in his "Life of the Bee" has much to say about the "spirit of the hive," and it does seem as if there were some mysterious agent or power at work there that cannot be located or defined.

This current effort to interpret nature has led one of the well-known prophets of the art to say that in this act of interpretation one "must struggle against fact and law to develop or keep his own individuality." This is certainly a curious notion, and I think an unsafe one, that the student of nature must struggle against fact and law, must ignore or override them, in order to give full swing to his own individuality. Is it himself, then, and not the truth that he is seeking to exploit? In the field of natural history we have been led to think the point at issue is not man's individuality, but correct observation — a true report of the wild life about us. Is one to give free rein to his fancy or imagination; to see animal life with his "vision," and not with his corporeal eyesight; to hear with his transcendental ear, and not through his auditory nerve? This may be all right in fiction or romance or fable, but why call the outcome natural history? Why set it down as a record of actual observation? Why penetrate the wilderness to interview Indians, trappers, guides, woodsmen, and thus seek to confirm your observations, if you have all the while been "struggling

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against fact and law," and do not want or need confirmation? If nature study is only to exploit your own individuality, why bother about what other people have or have not seen or heard? Why, in fact, go to the woods at all? Why not sit in your study and invent your facts to suit your fancyings?

My sole objection to the nature books that are the outcome of this proceeding is that they are put forth as veritable natural history, and thus mislead their readers. They are the result of a successful "struggle against fact and law" in a field where fact and law should be supreme. No doubt that, in the practical affairs of life, one often has a struggle with the fact. If one's bank balance gets on the negative side of the account, he must struggle to get it back where it belongs; he may even have the help of the bank's attorney to get it there. If one has a besetting sin of any kind, he has to struggle against that. Life is a struggle anyhow, and we are all strugglers — struggling to put the facts upon our side. But the only struggle the real nature student has with facts is to see them as they are, and to read them aright. He is just as zealous for the truth as is the man of science. In fact, nature study is only science out of school, happy in the fields and woods, loving the flower and the animal which it observes, and finding in them something for the sentiments and the emotions as well as for the understanding.

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With the nature student, the human interest in the wild creatures — by which I mean our interest in them as living, struggling beings — dominates the scientific interest, or our interest in them merely as subjects for comparison and classification.

Gilbert White was a rare combination of the nature student and the man of science, and his book is one of the minor English classics. Richard Jefferies was a true nature lover, but his interests rarely take a scientific turn. Our Thoreau was in love with the natural, but still more in love with the supernatural; yet he prized the fact, and his books abound in delightful natural history observations. We have a host of nature students in our own day, bent on plucking out the heart of every mystery in the fields and woods. Some are dryly scientific, some are dull and prosy, some are sentimental, some are sensational, and a few are altogether admirable. Mr. Thompson Seton, as an artist and *raconteur*, ranks by far the highest in this field, but in reading his works as natural history, one has to be constantly on guard against his romantic tendencies.

The structure of animals, their colors, their ornaments, their distribution, their migrations, all have a significance that science may interpret for us if it can, but it is the business of every observer to report truthfully what he sees, and not to confound his facts with his theories.

Why does the cowbird lay its egg in another bird's

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nest? Why are these parasitical birds found the world over? Who knows? Only there seems to be a parasitical principle in Nature that runs all through her works, in the vegetable as well as in the animal kingdom. Why is the porcupine so tame and stupid? Because it does not have to hunt for its game, and is self-armed against all comers. The struggle of life has not deveioped its wits. Why are robins so abundant? Because they are so adaptive, both as regards their food and their nesting-habits. They eat both fruit and insects, and will nest anywhere — in trees, sheds, walls, and on the ground. Why is the fox so cunning? Because the discipline of life has made him cunning. Man has probably always been after his fur; and his subsistence has not been easily obtained. If you ask me why the crow is so cunning, I shall be put to it for an adequate answer. It seems as if nobody could ever have wanted his skin or his carcass, and his diet does not compel him to outwit live game, as does that of the fox. His jet black plumage exposes him alike winter and summer. This drawback he has had to meet by added wit, but I can think of no other way in which he is handicapped. I do not know that he has any natural enemies; yet he is one of the most suspicious of the fowls of the air. Why is the Canada jay so much tamer than are other jays? They belong farther north, where they see less of man; they are birds of the wilderness; they are often, no doubt,

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hard put to it for food; their color does not make them conspicuous, — all these things, no doubt, tend to make them more familiar than their congeners. Why, again, the chickadee can be induced to perch upon your hand, and take food from it, more readily than can the nuthatch or the woodpecker, is a question not so easily answered. It being a lesser bird, it probably has fewer enemies than either of the others, and its fear would be less in proportion.

Why does the dog, the world over, use his nose in covering the bone he is hiding, and not his paw? Is it because his foot would leave a scent that would give his secret away, while his nose does not? He uses his paw in digging the hole for the bone, but its scent in this case would be obliterated by his subsequent procedure.

The foregoing is one way to interpret or explain natural facts. Everything has its reason. To hit upon this reason is to interpret it to the understanding. To interpret it to the emotions, or to the moral or to the æsthetic sense, that is another matter.

I would not be unjust or unsympathetic toward this current tendency to exalt the lower animals into the human sphere. I would only help my reader to see things as they are, and to stimulate him to love the animals as animals, and not as men. Nothing is gained by self-deception. The best discipline of life is that which prepares us to face the facts, no matter what they are. Such sweet companionship as one

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may have with a dog, simply because he is a dog and does not invade your own exclusive sphere! He is, in a way, like your youth come back to you, and taking form — all instinct and joy and adventure. You can ignore him, and he is not offended; you can reprove him, and he still loves you; you can hail him, and he bounds with joy; you can camp and tramp and ride with him, and his interest and curiosity and adventurous spirit give to the days and the nights the true holiday atmosphere. With him you are alone and not alone; you have both companionship and solitude. Who would have him more human or less canine? He divines your thought through his love, and feels your will in the glance of your eye. He is not a rational being, yet he is a very susceptible one, and touches us at so many points that we come to look upon him with a fraternal regard.

I suppose we should not care much for natural history, as I have before said, or for the study of nature generally, if we did not in some way find ourselves there; that is, something that is akin to our own feelings, methods, and intelligence. We have traveled that road, we find tokens of ourselves on every hand; we are "stuccoed with quadrupeds and birds all over," as Whitman says. The life-history of the humblest animal, if truly told, is profoundly interesting. If we could know all that befalls the slow moving turtle in the fields, or the

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toad that stumbles and fumbles along the roadside, our sympathies would be touched, and some spark of real knowledge imparted. We should not want the lives of those humble creatures "interpreted" after the manner of our sentimental "School of Nature Study," for that were to lose fact in fable; that were to give us a stone when we had asked for bread; we should want only a truthful record from the point of view of a wise, loving, human eye, such a record as, say, Gilbert White or Henry Thoreau might have given us. How interesting White makes his old turtle, hurrying to shelter when it rains, or seeking the shade of a cabbage leaf when the sun is too hot, or prancing about the garden on tiptoe in the spring by five in the morning, when the mating instinct begins to stir within him! Surely we may see ourselves in the old tortoise.

In fact, the problem of the essay-naturalist always is to make his subject interesting, and yet keep strictly within the bounds of truth.

It is always an artist's privilege to heighten or deepen natural effects. He may paint us a more beautiful woman, or a more beautiful horse, or a more beautiful landscape, than we ever saw; we are not deceived even though he outdo nature. We know where we stand and where he stands; we know that this is the power of art. If he is writing an animal romance like Kipling's story of the "White Seal," or like his "Jungle Book," there will

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be nothing equivocal about it, no mixture of fact and fiction, nothing to confuse or mislead the reader.

We know that here is the light that never was on sea or land, the light of the spirit. The facts are not falsified; they are transmuted. The aim of art is the beautiful, not *over* but *through* the true. The aim of the literary naturalist is the true, not over but through the beautiful; you shall find the exact facts in his pages, and you shall find them possessed of some of the allurements and suggestiveness that they had in the fields and woods. Only thus does his work attain to the rank of literature.

XII

A BEAVER'S REASON

ONE of our well-known natural historians thinks that there is no difference between a man's reason and a beaver's reason because, he says, when a man builds a dam, he first looks the ground over, and after due deliberation decides upon his plan, and a beaver, he avers, does the same. But the difference is obvious. Beavers, under the same conditions, build the same kind of dams and lodges; and all beavers as a rule do the same. Instinct is uniform in its workings; it runs in a groove. Reason varies endlessly and makes endless mistakes. Men build various kinds of dams and in various kinds of places, with various kinds of material and for various kinds of uses. They exercise individual judgment, they invent new ways and seek new ends, and of course often fail.

Every man has his own measure of reason, be it more or less. It is largely personal and original with him, and frequent failure is the penalty he pays for this gift.

But the individual beaver has only the inherited intelligence of his kind, with such slight addition as

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his experience may have given him. He learns to avoid traps, but he does not learn to improve upon his dam or lodge building, because he does not need to; they answer his purpose. If he had new and growing wants and aspirations like man, why then he would no longer be a beaver. He reacts to outward conditions, where man reflects and takes thought of things. His reason, if we prefer to call it such, is practically inerrant. It is blind, inasmuch as it is unconscious, but it is sure, inasmuch as it is adequate. It is a part of living nature in a sense that man's is not. If it makes a mistake, it is such a mistake as nature makes when, for instance, a hen produces an egg within an egg, or an egg without a yolk, or when more seeds germinate in the soil than can grow into plants.

A lower animal's intelligence, I say, compared with man's is blind. It does not grasp the subject perceived as ours does. When instinct perceives an object, it reacts to it, or not, just as the object is, or is not, related to its needs of one kind or another. In many ways an animal is like a child. What comes first in the child is simple perception and memory and association of memories, and these make up the main sum of an animal's intelligence. The child goes on developing till it reaches the power of reflection and of generalization — a stage of mentality that the animal never attains to.

All animal life is specialized; each animal is an

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expert in its own line of work — the work of its tribe. Beavers do the work of beavers, they cut down trees and build dams, and all beavers do it alike and with the same degree of untaught skill. This is instinct, or unthinking nature.

Of a hot day a dog will often dig down to fresh earth to get cooler soil to lie on. Or he will go and lie in the creek. All dogs do these things. Now if the dog were seen to carry stones and sods to dam up the creek to make a deeper pool to lie in, then he would in a measure be imitating the beavers, and this, in the dog, could fairly be called an act of reason, because it is not a necessity of the conditions of his life; it would be of the nature of an afterthought.

All animals of a given species are wise in their own way, but not in the way of another species. The robin could not build the oriole's nest, nor the oriole build the robin's nor the swallow's. The cunning of the fox is not the cunning of the coon. The squirrel knows a good deal more about nuts than the rabbit does, but the rabbit would live where the squirrel would die. The muskrat and the beaver build lodges much alike, that is, with the entrance under water and an inner chamber above the water, and this because they are both water-animals with necessities much the same.

Now, the mark of reason is that it is endlessly adaptive, that it can apply itself to all kinds of problems, that it can adapt old means to new ends, or

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new means to old ends, and is capable of progressive development. It holds what it gets, and uses that as a fulcrum to get more. But this is not at all the way of animal instinct, which begins and ends as instinct and is non-progressive.

A large part of our own lives is instinctive and void of thought. We go instinctively toward the warmth and away from the cold. All our affections are instinctive, and do not wait upon the reason. Our affinities are as independent of our reflection as gravity is. Our inherited traits, the ties of race, the spirit of the times in which we live, the impressions of youth, of climate, of soil, of our surroundings, — all influence our acts and often determine them without any conscious exercise of judgment or reason on our part. Then habit is all-potent with us, temperament is potent, health and disease are potent. Indeed, the amount of conscious reason that an ordinary man uses in his life, compared with the great unreason or blind impulse and inborn tendency that impel him, is like his artificial lights compared with the light of day — indispensable on special occasions, but a feeble matter, after all. Reason is an artificial light in the sense that it is not one with the light of nature, and in the sense that men possess it in varying degrees. The lower animals have only a gleam of it now and then. They are wise as the plants and trees are wise, and are guided by their inborn tendencies.

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Is instinct resourceful? Can it meet new conditions? Can it solve a new problem? If so, how does it differ from free intelligence or judgment? I am inclined to think that up to a certain point instinct is resourceful. Thus a Western correspondent writes: "At three different times I have pursued the common jack-rabbit from a level field, when the rabbit, coming to a furrow that ran at right angles to his course, jumped into it, and crouching down, slowly crept away to the end of the furrow, when it jumped out and ran at full speed again." This is a good example of the resourcefulness of instinct — the instinct to escape from an enemy — an old problem met by taking advantage of an unusual opportunity. To run, to double, to crouch, to hide, are probably all reflex acts with certain animals when hunted. The bird when pursued by a hawk rushes to cover in a tree or a bush, or beneath some object. Last summer I saw a bald eagle pursuing a fish hawk that held a fish in its talons. The hawk had a long start of the eagle, and began mounting upward, screaming in protest or defiance as it mounted. The pirate circled far beneath it for a few minutes, and then, seeing how he was distanced, turned back toward the ocean, so that I did not witness the little drama in the air that I had so long wished to see.

A wounded wild duck suddenly develops much cunning in escaping from the gunner — swimming

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under water, hiding by the shore with only the end of the bill in the air, or diving and seizing upon some object at the bottom, where it sometimes remains till life is extinct.

I once saw some farm-hands try to capture a fattened calf that had run all summer in a partly wooded field, till it had become rather wild. As the calf refused to be cornered, the farmer shot it with his rifle, but only inflicted a severe wound in the head. The calf then became as wild as a deer, and scaled fences in much the manner of the deer. When cornered, it turned and broke through the line in sheer desperation, and showed wonderful resources in eluding its pursuers. It coursed over the hills and gained the mountain, where it baffled its pursuers for two days before it was run down and caught. All such cases show the resources of instinct, the instinct of fear.

The skill of a bird in hiding its nest is very great, as is the cunning displayed in keeping the secret afterward. How careful it is not to betray the precious locality to the supposed enemy! Even the domestic turkey, when she hides her nest in the bush, if watched, approaches it by all manner of delays and indirections, and when she leaves it to feed, usually does so on the wing. I look upon these and kindred acts as exhibiting only the resourcefulness of instinct.

We are not to forget that the resourcefulness

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and flexibility of instinct which all animals show, some more and some less, is not reason, though it is doubtless the first step toward it. Out of it the conscious reason and intelligence of man probably have been evolved. I do not object to hearing this variability and plasticity of instinct called the twilight of mind or rudimentary mentality. It is that, or something like that. What I object to is hearing those things in animal life ascribed to reason that can be easier accounted for on the theory of instinct.

I must differ from the ornithologist of the New York Zoölogical Park when he says in a recent paper that a bird's affection for her young is not an instinct, an uncontrollable emotion, but I quite agree with him that it does not differ, in kind at least, from the emotion of the human mother. In both cases the affection is instinctive, and not a matter of reason, or forethought, or afterthought at all. The two affections differ in this: that one is brief and transient, and the other is deep and lasting. Under stress of circumstances the bird will abandon her helpless young, while the human mother will not. When the food supply fails, the lower animal will not share the last morsel with its young; its fierce hunger makes it forget them. During the cold, wet summer of 1903 a vast number of half-fledged birds—orioles, finches, warblers—perished in the nest, probably from scarcity of insect food and the neglect of the mothers to hover them.

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In interpreting the action of the animals, we so often do the thinking and reasoning ourselves which we attribute to them. Thus Mr. Beebe in the paper referred to says: "Birds have early learned to take clams or mussels in their beaks or claws at low tide and carry them out of the reach of the water, so that at the death of the mollusk, the relaxation of the adductor muscle would permit the shell to spring open and afford easy access to the inmate." No doubt the advancing tide would cause the bird to carry the shell-fish back out of the reach of the waves, where it might hope to get at its meat, but where it would be compelled to leave the shell unopened. But that the bird knew the fish would die there and that its shell would then open—it is in such particulars that the observer does the thinking.

Two other writers upon our birds have stated that pelicans will gather in flocks along the shore, and by manœuvring and beating the water with their wings, will drive the fish into the shallows, where they easily capture them. Here again the observer thinks for the observed. The pelicans see the fish and pursue them, without any plan to corner them in shoal water, but the inevitable result is that they are so cornered and captured. The fish are foolish, but the pelicans are not wise. The wisdom here attributed to them is human wisdom and not animal wisdom.

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To observe the actions of the lower animals without reading our own thoughts into them is not an easy matter. Mr. Beebe thinks that when in early spring the peacock, in the Zoölogical Park, timidly erects its plumes before an unappreciative crow, it is merely practicing the art of showing off its gay plumes in anticipation of the time when it shall compete with its rivals before the females; in other words, that it is rehearsing its part. But I should say that the peacock struts before the crow or before spectators because it can't help it. The sexual instinct begins to flame up and master it. The fowl can no more control it than it can control its appetite for food. To practice beforehand is human. Animal practice takes the form of spontaneous play. The mock battles of two dogs or of other animals are not conscious practice on their part, but are play pure and simple, the same as human games, though their value as training is obvious enough.

Animals do not have general ideas; they receive impressions through their various senses, to which they respond. I recently read in manuscript a very clear and concise paper on the subject of animal thinking compared with that of man, in which the writer says: "There is a rudimentary abstraction before language. All the higher animals have general ideas of 'good-for-eating' and 'not-good-for-eating,' quite apart from any particular objects of which either of these qualities happens to be char-

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acteristic." It is at this point, I think, that the writer referred to goes wrong. The animal has no idea at all about what is good to eat and what is not good; it is guided entirely by its senses. It reacts to the stimuli that reach it through the sight or smell, usually the latter. There is no mental process at all in the matter, not the most rudimentary; there is simple reaction to stimuli, as strictly so as when we sneeze on taking snuff. Man alone has ideas of what is good to eat and what is not good. When a fox prowls about a farmhouse, he has no general idea that there are eatable things there, as the essayist above referred to alleges. He is simply following his nose; he smells something to which he responds. We think for him when we attribute to him general ideas of what he is likely to find at the farmhouse. But when a man goes to a restaurant, he follows an idea and not his nose, he compares the different viands in his mind, and often decides beforehand what he will have. There is no agreement in the two cases at all. If, when the bird chooses the site for its nest, or the chipmunk or the woodchuck the place for its hole, or the beaver the spot for its dam, we make these animals think, compare, weigh, we are simply putting ourselves in their place and making them do as we would do under like conditions.

Animal life parallels human life at many points, but it is in another plane. Something guides the

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lower animals, but it is not thought; something restrains them, but it is not judgment; they are provident without prudence; they are active without industry; they are skillful without practice; they are wise without knowledge; they are rational without reason; they are deceptive without guile. They cross seas without a compass, they return home without guidance, they communicate without language, their flocks act as a unit without signals or leaders. When they are joyful, they sing or they play; when they are distressed, they moan or they cry; when they are jealous, they bite or they claw, or they strike or they gore, — and yet I do not suppose they experience the emotions of joy or sorrow, or anger or love, as we do, because these feelings in them do not involve reflection, memory, and what we call the higher nature, as with us.

The animals do not have to consult the almanac to know when to migrate or to go into winter quarters. At a certain time in the fall, I see the newts all making for the marshes; at a certain time in the spring, I see them all returning to the woods again. At one place where I walk, I see them on the railroad track wandering up and down between the rails, trying to get across. I often lend them a hand. They know when and in what direction to go, but not in the way I should know under the same circumstances. I should have to learn or be told; they know instinctively.

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We marvel at what we call the wisdom of Nature, but how unlike our own! How blind, and yet in the end how sure! How wasteful, and yet how conserving! How helter-skelter she sows her seed, yet behold the forest or the flowery plain. Her springs leap out everywhere, yet how inevitably their waters find their way into streams, the streams into rivers, and the rivers to the sea. Nature is an engineer without science, and a builder without rules.

The animals follow the tides and the seasons; they find their own; the fittest and the luckiest survive; the struggle for life is sharp with them all; birds of a feather flock together; the young cowbirds reared by many different foster-parents all gather in flocks in the fall; they know their kind — at least, they are attracted by their kind.

A correspondent asks me if I do not think the minds of animals capable of improvement. Not in the strict sense. When we teach an animal anything, we make an impression upon its senses and repeat this impression over and over, till we establish a habit. We do not bring about any mental development as we do in the child; we mould and stamp its sense memory. It is like bending or compressing a vegetable growth till it takes a certain form.

The human animal sees through the trick, he comprehends it and does not need the endless repetition. When repetition has worn a path in our minds, then we, too, act automatically, or without

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conscious thought, as we do, for instance, in forming the letters when we write.

Wild animals are trained, but not educated. We multiply impressions upon them without adding to their store of knowledge, because they cannot evolve general ideas from these sense impressions. Here we reach their limitations. A bluebird or a robin will fight its reflected image in the window-pane of a darkened room day after day, and never master the delusion. It can take no step beyond the evidence of its senses — a hard step even for man to take. You may train your dog so that he will bound around you when he greets you without putting his feet upon you. But do you suppose the fond creature ever comes to know why you do not want his feet upon you? If he does, then he takes the step in general knowledge to which I have referred. Your cow, tethered by a long rope upon the lawn, learns many things about that rope and how to manage it that she did not know when she was first tied, but she can never know why she is tethered, or why she is not to crop the shrubbery, or paw up the turf, or reach the corn on the edge of the garden. This would imply general ideas or power of reflection. You might punish her until she was afraid to do any of these things, but you could never enlighten her on the subject. The rudest savage can, in a measure, be enlightened, he can be taught the reason why of things, but an animal

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cannot. We can make its impulses follow a rut, so to speak, but we cannot make them free and self-directing. Animals are the victims of habits inherited or acquired.

I was told of a fox that came nightly prowling about some deadfalls set for other game. The new-fallen snow each night showed the movements of the suspicious animal; it dared not approach nearer than several feet to the deadfalls. Then one day a red-shouldered hawk seized the bait in one of the traps, and was caught. That night a fox, presumably the same one, came and ate such parts of the body of the hawk as protruded from beneath the stone. Now, how did the fox know that the trap was sprung and was now harmless? Did not its act imply something more than instinct? We have the cunning and suspicion of the fox to start with; these are factors already in the problem that do not have to be accounted for. To the fox, as to the crow, anything that looks like design or a trap, anything that does not match with the haphazard look and general disarray of objects in nature, will put it on its guard. A deadfall is a contrivance that is not in keeping with the usual fortuitous disarray of sticks and stones in the fields and woods. The odor of the man's hand would also be there, and this of itself would put the fox on its guard. But a hawk or any other animal crushed by a stone, with part of its body protruding from beneath the stone,

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has quite a different air. It at least does not look threatening; the rock is not impending; the open jaws are closed. More than that, the smell of the man's hand would be less apparent, if not entirely absent. The fox drew no rational conclusions; its instinctive fear was allayed by the changed conditions of the trap. The hawk has not the fox's cunning, hence it fell an easy victim. I do not think that the cunning of the fox is any more akin to reason than is the power of smell of the hound that pursues him. Both are inborn, and are quite independent of experience. If a fox were deliberately to seek to elude the hound by running through a flock of sheep, or by following the bed of a shallow stream, or by taking to the public highway, then I think we should have to credit him with powers of reflection. It is true he often does all these things, but whether he does them by chance, or of set purpose, admits of doubt.

The cunning of a fox is as much a part of his inherited nature as is his fleetness of foot. All the more notable fur-bearing animals, as the fox, the beaver, the otter, have doubtless been persecuted by man and his savage ancestors for tens of thousands of years, and their suspicion of traps and lures, and their skill in eluding them, are the accumulated inheritance of ages.

In denying what we mean by thought or free intelligence to animals, an exception should un-

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doubtedly be made in favor of the dog. I have elsewhere said that the dog is almost a human product; he has been the companion of man so long, and has been so loved by him, that he has come to partake, in a measure at least, of his master's nature. If the dog does not at times think, reflect, he does something so like it that I can find no other name for it. Take so simple an incident as this, which is of common occurrence: A collie dog is going along the street in advance of its master's team. It comes to a point where the road forks; the dog takes, say, the road to the left and trots along it a few rods, and then, half turning, suddenly pauses and looks back at the team. Has he not been struck by the thought, "I do not know which way my master is going: I will wait and see"? If the dog in such cases does not reflect, what does he do? Can we find any other word for his act? To ask a question by word or deed involves some sort of a mental process, however rudimentary. Is there any other animal that would act as the collie did under like circumstances?

A Western physician writes me that he has on three different occasions seen his pointer dog behave as follows: He had pointed a flock of quail, that would not sit to be flushed, but kept running. Then the dog, without a word or sign from his master, made a long *détour* to the right or to the left around the retreating birds, headed them off, and

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then slowly advanced, facing the gunner, till he came to a point again, with the quail in a position to be flushed. After crediting the instinct and the training of the dog to the full, such an act, I think, shows a degree of independent judgment. The dog had not been trained to do that particular thing, and took the initiative of his own accord.

Many authentic stories are told of cats which seem to show that they too have profited in the way of added intelligence by their long intercourse with man. A lady writing to me from New York makes the following discriminating remarks upon the cat:—

“It seems to me that the reason which you ascribe for the semi-humanizing of the dog, his long intercourse with man, might apply in some degree to the cat. But it is necessary to be very fond of cats in order to perceive their qualities. The dog is ‘up in every one’s face,’ so to speak ; always in evidence ; always on deck. But the cat is a shy, reserved, exclusive creature. The dog is the humble friend, follower, imitator, and slave of man. He will lick the foot that kicks him. The cat, instead, will scratch. The dog begs for notice. The cat must be loved much and courted assiduously before she will blossom out and humanize under the atmosphere of affection. The dog seems to me to have the typical qualities of the negro, the cat of the Indian. She is indifferent to man, cares nothing

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for him unless he wins her by special and consistent kindness, and throughout her long domestication has kept her wild independence, and ability to forage for herself when turned loose, whether in forest or city street. It is when she is much loved and petted that her intelligence manifests itself, in such quiet ways that an indifferent observer will never notice them. But she always knows who is fond of her, and which member of the family is fondest of her."

The correspondent who had the experience with his pointer dog relates this incident about his blooded mare: A drove of horses were pasturing in a forty-acre lot. The horses had paired off, as horses usually do under such circumstances. The doctor's thoroughbred mare had paired with another mare that was totally blind, and had been so since a colt. Through the field "ran a little creek which could not well be crossed by the horses except at a bridge at one end." One day when the farmer went to salt the animals, they all came galloping over the bridge and up to the gate, except the blind one; she could not find the bridge, and remained on the other side, whinnying and stamping, while the others were getting their salt a quarter of a mile away. Presently the blooded mare suddenly left her salt, made her way through the herd, and went at a flying gallop down across the bridge to the blind animal. Then she turned and came back, followed by the blind

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one. The doctor is convinced that his mare deliberately went back to conduct her blind companion over the bridge and down to the salt-lick. But the act may be more simply explained. How could the mare have known her companion was blind? What could any horse know about such a disability? The only thing implied in the incident is the attachment of one animal for another. The mare heard her mate calling, probably in tones of excitement or distress, and she flew back to her. Finding her all right, she turned toward the salt again and was followed by her fellow. Instinct did it all.

My own observation of the wild creatures has revealed nothing so near to human thought and reflection as is seen in the cases of the collie and pointer dogs above referred to. The nearest to them of anything I can now recall is an incident related by an English writer, Mr. Kearton. In one of his books, Mr. Kearton relates how he has frequently fooled sitting birds with wooden eggs. He put his counterfeits, painted and marked like the originals, into the nests of the song thrush, the blackbird, and the grasshopper warbler, and in no case was the imposition detected. In the warbler's nest he placed dummy eggs twice the size of her own, and the bird proceeded to brood them without the slightest sign of suspicion that they were not of her own laying.

But when Mr. Kearton tried his counterfeits

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upon a ring plover, the fraud was detected. The plover hammered the shams with her bill "in the most skeptical fashion," and refused to sit down upon them. When two of the bird's own eggs were returned to the nest and left there with two wooden ones, the plover tried to throw out the shams, but failing to do this, "reluctantly sat down and covered good and bad alike."

Now, can the action of the plover in this case be explained on the theory of instinct alone? The bird could hardly have had such an experience before. It was offered a counterfeit, and it behaved much as you or I would have done under like conditions, although we have the general idea of counterfeits, which the plover could not have had. Of course, everything that pertains to the nest and eggs of a bird is very vital to it. The bird is wise about these things from instinct. Yet the other birds were easily fooled. We do not know how nearly perfect Mr. Kearton's imitation eggs were, but evidently there was some defect in them which arrested the bird's attention. If the incident does not show powers of reflection in the bird, it certainly shows keen powers of perception; and that birds, and indeed all animals, show varying degrees of this power, is a matter of common observation. I hesitate, therefore, to say that Mr. Kearton's plover showed anything more than very keen instincts. Among our own birds there is only one, so far as I know,

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that detects the egg of the cowbird when it is laid in the bird's nest, and that is the yellow warbler. All the other birds accept it as their own, but this warbler detects the imposition, and proceeds to get rid of the strange egg by burying it under a new nest bottom.

Man is undoubtedly of animal origin. The road by which he has come out of the dim past lies through the lower animals. The germ and potentiality of all that he has become or can become was sleeping there in his humble origins. Of this I have no doubt. Yet I think we are justified in saying that the difference between animal intelligence and human reason is one of kind and not merely of degree. Flying and walking are both modes of locomotion, and yet may we not fairly say they differ in kind? Reason and instinct are both manifestations of intelligence, yet do they not belong to different planes? Intensify animal instinct ever so much, and you have not reached the plane of reason. The homing instinct of certain animals is far beyond any gift of the kind possessed by man, and yet it seems in no way akin to reason. Reason heeds the points of the compass and takes note of the topography of the country, but what can animals know of these things?

And yet I say the animal is father of the man. Without the lower orders, there could have been no higher. In my opinion, no miracle or special

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creation is required to account for man. The transformation of force, as of heat into light or electricity, is as great a leap and as mysterious as the transformation of animal intelligence into human reason.

XIII

READING THE BOOK OF NATURE

IN studying Nature, the important thing is not so much what we see as how we interpret what we see. Do we get at the true meaning of the facts? Do we draw the right inference? The fossils in the rocks were long observed before men drew the right inference from them. So with a hundred other things in nature and life.

During May and a part of June of 1903, a drouth of unusual severity prevailed throughout the land. The pools and marshes nearly all dried up. Late in June the rains came again and filled them up. Then an unusual thing happened: suddenly, for two or three days and nights, the marshes about me were again vocal with the many voices of the hyla, the "peepers" of early spring. That is the fact. Now, what is the interpretation? With me the peepers become silent in early May, and, I suppose, leave the marshes for their life in the woods. Did the drouth destroy all their eggs and young, and did they know this and so come back to try again? How else shall one explain their second appearance in the marshes? But how did they know of the de-

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struction of their young, and how can we account for their concerted action? These are difficulties not easily overcome. A more rational explanation to me is this, namely, that the extreme dryness of the woods — nearly two months without rain — drove the little frogs to seek for moisture in their spring haunts, where in places a little water would be pretty certain to be found. Here they were holding out, probably hibernating again, as such creatures do in the tropics during the dry season, when the rains came, and here again they sent up their spring chorus of voices, and, for aught I know, once more deposited their eggs. This to me is much more like the ways of Nature with her creatures than is the theory of the frogs' voluntary return to the swamps and pools to start the season over again.

The birds at least show little or no wit when a new problem is presented to them. They have no power of initiative. Instinct runs in a groove, and cannot take a step outside of it. One May day we started a meadowlark from her nest. There were three just hatched young in the nest, and one egg lying on the ground about two inches from the nest. I suspected that this egg was infertile and that the bird had had the sense to throw it out, but on examination it was found to contain a nearly grown bird. The inference was, then, that the egg had been accidentally carried out of the nest some time when the sitting bird had taken a sudden flight,

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and that she did not have the sense to roll or carry it back to its place.

There is another view of the case which no doubt the sentimental "School of Nature Study" would eagerly adopt: A very severe drouth reigned throughout the land; food was probably scarce, and was becoming scarcer; the bird foresaw her inability to care for four young ones, and so reduced the possible number by ejecting one of the eggs from the nest. This sounds pretty and plausible, and so credits the bird with the wisdom that the public is so fond of believing it possesses. Something like this wisdom often occurs among the hive bees in seasons of scarcity; they will destroy the unhatched queens. But birds have no such foresight, and make no such calculations. In cold, backward seasons, I think, birds lay fewer eggs than when the season is early and warm, but that is not a matter of calculation on their part; it is the result of outward conditions.

A great many observers and nature students at the present time are possessed of the notion that the birds and beasts instruct their young, train them and tutor them, much after the human manner. In the familiar sight of a pair of crows foraging with their young about a field in summer, one of our nature writers sees the old birds giving their young a lesson in flying. She says that the most important thing that the elders had to do was

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to teach the youngsters how to fly. This they did by circling about the pasture, giving a peculiar call while they were followed by their flock — all but one. This was a bobtailed crow, and he did not obey the word of command. His mother took note of his disobedience and proceeded to discipline him. He stood upon a big stone, and she came down upon him and knocked him off his perch. "He squawked and fluttered his wings to keep from falling, but the blow came so suddenly that he had not time to save himself, and he fell flat on the ground. In a minute he clambered back upon his stone, and I watched him closely. The next time the call came to fly he did not linger, but went with the rest, and so long as I could watch him he never disobeyed again." I should interpret this fact of the old and young crows flying about a field in summer quite differently. The young are fully fledged, and are already strong flyers, when this occurs. They do not leave the nest until they can fly well and need no tutoring. What the writer really saw was what any one may see on the farm in June and July: she saw the parent crows foraging with their young in a field. The old birds flew about, followed by their brood, clamorous for the food which their parents found. The bobtailed bird, which had probably met with some accident, did not follow, and the mother returned to feed it; the young crow lifted its wings and flapped them, and in its eagerness probably

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fell off its perch ; then when its parent flew away, it followed.

I think it highly probable that the sense or faculty by which animals find their way home over long stretches of country, and which keeps them from ever being lost as man so often is, is a faculty entirely unlike anything man now possesses. The same may be said of the faculty that guides the birds back a thousand miles or more to their old breeding-haunts. In caged or housed animals I fancy this faculty soon becomes blunted. President Roosevelt tells in his "Ranch Life" of a horse he owned that ran away two hundred miles across the plains, swimming rivers on the way to its old home. It is very certain, I think, that this homing feat is not accomplished by the aid of either sight or scent, for usually the returning animal seems to follow a comparatively straight line. It is, or seems to be, a consciousness of direction that is as unerring as the magnetic needle. Reason, calculation, and judgment err, but these primary instincts of the animal seem almost infallible.

In Bronx Park in New York a grebe and a loon lived together in an inclosure in which was a large pool of water. The two birds became much attached to each other and were never long separated. One winter day on which the pool was frozen over, except a small opening in one end of it, the grebe dived under the ice and made its way to the far

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end of the pool, where it remained swimming about aimlessly for some moments. Presently the loon missed its companion, and with an apparent look of concern dived under the ice and joined it at the closed end of the pool. The grebe seemed to be in distress for want of air. Then the loon settled upon the bottom, and with lifted beak sprang up with much force against the ice, piercing it with its dagger-like bill, but not breaking it. Down to the bottom it went again, and again hurled itself up against the ice, this time shattering it and rising to the surface, where the grebe was quick to follow. Now it looked as if the loon had gone under the ice to rescue its friend from a dangerous situation, for had not the grebe soon found the air, it must have perished, and persons who witnessed the incident interpreted it in this way. It is in such cases that we are so apt to read our human motives and emotions into the acts of the lower animals. I do not suppose the loon realized the danger of its companion, nor went under the ice to rescue it. It followed the grebe because it wanted to be with it, or to share in any food that might be detaining it there, and then, finding no air-hole, it proceeded to make one, as it and its ancestors must often have done before. All our northern divers must be more or less acquainted with ice, and must know how to break it. The grebe itself could doubtless have broken the ice had it desired to. The birds and the

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beasts often show much intelligence, or what looks like intelligence, but, as Hamerton says, "the moment we think of them as *human*, we are lost."

A farmer had a yearling that sucked the cows. To prevent this, he put on the yearling a muzzle set full of sharpened nails. These of course pricked the cows, and they would not stand to be drained of their milk. The next day the farmer saw the yearling rubbing the nails against a rock in order, as he thought, to dull them so they would not prick the cows! How much easier to believe that the beast was simply trying to get rid of the awkward incumbrance upon its nose. What can a calf or a cow know about sharpened nails, and the use of a rock to dull them? This is a kind of outside knowledge — outside of their needs and experiences — that they could not possess.

An Arizona friend of mine lately told me this interesting incident about the gophers that infested his cabin when he was a miner. The gophers ate up his bread. He could not hide it from them or put it beyond their reach. Finally, he bethought him to stick his loaf on the end of a long iron poker that he had, and then stand up the poker in the middle of his floor. Still, when he came back to his cabin, he would find his loaf eaten full of holes. One day, having nothing to do, he concluded to watch and see how the gophers reached the bread, and this was what he saw: The animals climbed up the side

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of his log cabin, ran along one of the logs to a point opposite the bread, and then sprang out sidewise toward the loaf, which each one struck, but upon which only one seemed able to effect a lodgment. Then this one would cling to the loaf and act as a stop to his fellows when they tried a second time, his body affording them the barrier they required. My friend felt sure that this leader deliberately and consciously aided the others in securing a footing on the loaf. But I read the incident differently. This successful jumper aided his fellows without designing it. The exigencies of the situation compelled him to the course he pursued. Having effected a lodgment upon the impaled loaf, he would of course cling to it when the others jumped so as not to be dislodged, thereby, willy nilly, helping them to secure a foothold. The coöperation was inevitable, and not the result of design.

The power to see straight is the rarest of gifts; to see no more and no less than is actually before you; to be able to detach yourself and see the thing as it actually is, uncolored or unmodified by your own sentiments or prepossessions. In short, to see with your reason as well as with your perceptions, that is to be an observer and to read the book of nature aright.

XIV

GATHERED BY THE WAY

I. THE TRAINING OF WILD ANIMALS

I WAS reminded afresh of how prone we all are to regard the actions of the lower animals in the light of our own psychology on reading "The Training of Wild Animals," by Bostock, a well-known animal-trainer. Bostock evidently knows well the art of training animals, but of the science of it he seems to know very little. That is, while he is a successful trainer, his notions of animal psychology are very crude. For instance, on one page he speaks of the lion as if it were endowed with a fair measure of human intelligence, and had notions, feelings, and thoughts like our own; on the next page, when he gets down to real business, he lays bare its utter want of these things. He says a lion born and bred in captivity is more difficult to train than one caught from the jungle. Then he gives rein to his fancy. "Such a lion does not fear man; he knows his own power. He regards man as an inferior, with an attitude of disdain and silent hauteur." "He accepts his food as tribute, and his care as homage due." "He is aristocratic in his independence."

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"Deep in him — so deep that he barely realizes its existence — slumbers a desire for freedom and an unutterable longing for the blue sky and the free air." When his training is begun, "he meets it with a reserved majesty and silent indifference, as though he had a dumb realization of his wrongs." All this is a very human way of looking at the matter, and is typical of the way we all — most of us — speak of the lower animals, defining them to ourselves in terms of our own mentality, but it leads to false notions about them. We look upon an animal fretting and struggling in its cage as longing for freedom, picturing to itself the joy of the open air and the free hills and sky, when the truth of the matter undoubtedly is that the fluttering bird or restless fox or lion simply feels discomfort in confinement. Its sufferings are physical, and not mental. Its instincts lead it to struggle for freedom. It reacts strongly against the barriers that hold it, and tries in every way to overcome them. Freedom, as an idea, or a conception of a condition of life, is, of course, beyond its capacity.

Bostock shows how the animal learns entirely by association, and not at all by the exercise of thought or reason, and yet a moment later says: "The animal is becoming amenable to the mastery of man, and in doing so his own reason is being developed," which is much like saying that when a man is practicing on the flying trapeze his wings are being de-

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veloped. The lion learns slowly through association — through repeated sense impressions. First a long stick is put into his cage. If this is destroyed, it is replaced by another, until he gets used to it and tolerates its presence. Then he is gently rubbed with it at the hands of his keeper. He gets used to this and comes to like it. Then the stick is baited with a piece of meat, and in taking the meat the animal gets still better acquainted with the stick, and so ceases to fear it. When this stage is reached, the stick is shortened day by day, "until finally it is not much longer than the hand." The next step is to let the hand take the place of the stick in the stroking process. "This is a great step taken, for one of the most difficult things is to get any wild animal to allow himself to be touched with the human hand." After a time a collar with a chain attached is slipped around the lion's neck when he is asleep. He is now chained to one end of the cage. Then a chair is introduced into the cage; whereupon this king of beasts, whose reason is being developed, and who has such clear notions of inferior and superior, and who knows his own powers, usually springs for the chair, seeking to demolish it. His tether prevents his reaching it, and so in time he tolerates the chair. Then the trainer, after some preliminary feints, walks into the cage and seats himself in the chair. And so, inch by inch, as it were, the trainer gets control of the animal and subdues him to his purposes, not by appealing

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to his mind, for he has none, but by impressions upon his senses.

“Leopards, panthers, and jaguars are all trained in much the same manner,” and in putting them through their tricks one invariable order must be observed: “Each thing done one day must be done the next day in exactly the same way; there must be no deviation from the rule.” Now we do not see in this fact the way of a thinking or reflecting being, but rather the way of a creature governed by instinct or unthinking intelligence. An animal never *learns* a trick in the sense that man learns it, never sees through it or comprehends it, has no image of it in its mind, and no idea of the relations of the parts of it to one another; it does it by reason of repetition, as a creek wears its channel, and probably has no more self-knowledge or self-thought than the creek has. This, I think, is quite contrary to the popular notion of animal life and mentality, but it is the conclusion that I, at least, cannot avoid after making a study of the subject.

II. AN ASTONISHED PORCUPINE

One summer, while three young people and I were spending an afternoon upon a mountain-top, our dogs treed a porcupine. At my suggestion the young man climbed the tree — not a large one — to shake the animal down. I wished to see what the dogs would do with him, and what the “quill-pig”

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would do with the dogs. As the climber advanced the rodent went higher, till the limb he clung to was no larger than one's wrist. This the young man seized and shook vigorously. I expected to see the slow, stupid porcupine drop, but he did not. He only tightened his hold. The climber tightened his hold, too, and shook the harder. Still the bundle of quills did not come down, and no amount of shaking could bring it down. Then I handed a long pole up to the climber, and he tried to punch the animal down. This attack in the rear was evidently a surprise; it produced an impression different from that of the shaking. The porcupine struck the pole with his tail, put up the shield of quills upon his back, and assumed his best attitude of defense. Still the pole persisted in its persecution, regardless of the quills; evidently the animal was astonished: he had never had an experience like this before; he had now met a foe that despised his terrible quills. Then he began to back rapidly down the tree in the face of his enemy. The young man's sweetheart stood below, a highly interested spectator. "Look out, Sam, he's coming down!" "Be quick, he's gaining on you!" "Hurry, Sam!" Sam came as fast as he could, but he had to look out for his footing, and his antagonist did not. Still, he reached the ground first, and his sweetheart breathed more easily. It looked as if the porcupine reasoned thus: "My quills are useless against a foe so far away;

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"I must come to close quarters with him." But, of course, the stupid creature had no such mental process, and formed no such purpose. He had found the tree unsafe, and his instinct now was to get to the ground as quickly as possible and take refuge among the rocks. As he came down I hit him a slight blow over the nose with a rotten stick, hoping only to confuse him a little, but much to my surprise and mortification he dropped to the ground and rolled down the hill dead, having succumbed to a blow that a woodchuck or a coon would hardly have regarded at all. Thus does the easy, passive mode of defense of the porcupine not only dull his wits, but it makes frail and brittle the thread of his life. He has had no struggles or battles to harden and toughen him.

That blunt nose of his is as tender as a baby's, and he is snuffed out by a blow that would hardly bewilder for a moment any other forest animal, unless it be the skunk, another sluggish non-combatant of our woodlands. Immunity from foes, from effort, from struggle is always purchased with a price.

Certain of our natural history romancers have taken liberties with the porcupine in one respect: they have shown him made up into a ball and rolling down a hill. One writer makes him do this in a sportive mood; he rolls down a long hill in the woods, and at the bottom he is a ragged mass of leaves which his quills have impaled — an apparition that nearly frightened a rabbit out of its wits.

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Let any one who knows the porcupine try to fancy it performing a feat like this!

Another romancer makes his porcupine roll himself into a ball when attacked by a panther, and then on a nudge from his enemy roll down a snowy incline into the water. I believe the little European hedgehog can roll itself up into something like a ball, but our porcupine does not. I have tried all sorts of tricks with him, and made all sorts of assaults upon him, at different times, and I have never yet seen him assume the globular form. It would not be the best form for him to assume, because it would partly expose his vulnerable under side. The one thing the porcupine seems bent upon doing at all times is to keep right side up with care. His attitude of defense is crouching close to the ground, head drawn in and pressed down, the circular shield of large quills upon his back opened and extended as far as possible, and the tail stretched back rigid and held close upon the ground. "Now come on," he says, "if you want to." The tail is his weapon of active defense; with it he strikes upward like lightning, and drives the quills into whatever they touch. In his chapter called "In Panoply of Spears," Mr. Roberts paints the porcupine without taking any liberties with the creature's known habits. He portrays one characteristic of the porcupine very felicitously: "As the porcupine made his resolute way through the woods, the manner of his going differed from that of all the other

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kindreds of the wild. He went not furtively. He had no particular objection to making a noise. He did not consider it necessary to stop every little while, stiffen himself to a monument of immobility, cast wary glances about the gloom, and sniff the air for the taint of enemies. He did not care who knew of his coming, and he did not greatly care who came. Behind his panoply of biting spears he felt himself secure, and in that security he moved as if he held in fee the whole green, shadowy, perilous woodland world."

III. BIRDS AND STRINGS

A college professor writes me as follows: —

"Watching this morning a robin attempting to carry off a string, one end of which was caught in a tree, I was much impressed by his utter lack of sense. He could not realize that the string was fast, or that it must be loosened before it could be carried off, and in his efforts to get it all in his bill he wound it about a neighboring limb. If as little sense were displayed in using other material for nests, there would be no robins' nests. It impressed me more than ever with the important part played by instinct."

Who ever saw any of our common birds display any sense or judgment in the handling of strings? Strings are comparatively a new thing with birds; they are not a natural product, and as a

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matter of course birds blunder in handling them. The oriole uses them the most successfully, often attaching her pensile nest to the branch by their aid. But she uses them in a blind, childish way, winding them round and round the branch, often getting them looped over a twig or hopelessly tangled, and now and then hanging herself with them, as is the case with other birds. I have seen a sparrow, a cedar-bird, and a robin each hung by a string it was using in the building of its nest. Last spring, in Spokane, a boy brought me a desiccated robin, whose feet were held together by a long thread hopelessly snarled. The boy had found it hanging to a tree.

I have seen in a bird magazine a photograph of an oriole's nest that had a string carried around a branch apparently a foot or more away, and then brought back and the end woven into the nest. It was given as a sample of a well-guyed nest, the discoverer no doubt looking upon it as proof of an oriole's forethought in providing against winds and storms. I have seen an oriole's nest with a string carried around a leaf, and another with a long looped string hanging free. All such cases simply show that the bird was not master of her material; she bungled; the trailing string caught over the leaf or branch, and she drew both ends in and fastened them regardless of what had happened. The incident only shows how blindly instinct works.

Twice I have seen cedar-birds, in their quest for

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nesting-material, trying to carry away the strings that orioles had attached to branches. According to our sentimental "School of Nature Study," the birds should have untied and unsnarled the strings in a human way, but they did not; they simply tugged at them, bringing their weight to bear, and tried to fly away with the loose end.

In view of the ignorance of birds with regard to strings, how can we credit the story told by one of our popular nature writers of a pair of orioles that deliberately impaled a piece of cloth upon a thorn in order that it might be held firmly while they pulled out the threads? When it came loose, they refastened it. The story is incredible for two reasons: (1) the male oriole does not assist the female in building the nest; he only furnishes the music; (2) the whole proceeding implies an amount of reflection and skill in dealing with a new problem that none of our birds possess. What experience has the race of orioles had with cloth, that any member of it should know how to unravel it in that way? The whole idea is absurd.

IV. MIMICRY

To what lengths the protective resemblance theory is pushed by some of its expounders! Thus, in the neighborhood of Rio Janeiro there are two species of hawks that closely resemble each other, but one eats only insects and the other eats birds.

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Mr. Wallace thinks that the bird-eater mimics the insect-eater, so as to deceive the birds, which are not afraid of the latter. But if the two hawks look alike, would not the birds come to regard them both as bird-eaters, since one of them does eat birds? Would they not at once identify the harmless one with their real enemy and thus fear them both alike? If the latter were newcomers and vastly in the minority, then the ruse might work for a while. But if there were ten harmless hawks around to one dangerous one, the former would quickly suffer from the character of the latter in the estimation of the birds. Birds are instinctively afraid of all hawk kind.

Wallace thinks it may be an advantage to cuckoos, a rather feeble class of birds, to resemble the hawks, but this seems to me far-fetched. True it is, if the sheep could imitate the wolf, its enemies might keep clear of it. Why, then, has not this resemblance been brought about? Our cuckoo is a feeble and defenseless bird also, but it bears no resemblance to the hawk. The same can be said of scores of other birds.

Many of these close resemblances among different species of animals are no doubt purely accidental, or the result of the same law of variation acting under similar conditions. We have a hummingbird moth that so closely in its form and flight and manner resembles a hummingbird, that if this resemblance brought it any immunity from danger it

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would be set down as a clear case of mimicry. There is such a moth in England, too, where no hummingbird is found. Why should not Nature repeat herself in this way? This moth feeds upon the nectar of flowers like the hummingbird, and why should it not have the hummingbird's form and manner?

Then there are accidental resemblances in nature, such as the often-seen resemblance of knots of trees and of vegetables to the human form, and of a certain fungus to a part of man's anatomy. We have a fly that resembles a honey-bee. In my bee-hunting days I used to call it the "mock honey-bee." It would come up the wind on the scent of my bee box and hum about it precisely like a real bee. Of course it was here before the honey-bee, and has been evolved quite independently of it. It feeds upon the pollen and nectar of flowers like the true bee, and is, therefore, of similar form and color. The honey-bee has its enemies; the toads and tree-frogs feed upon it, and the kingbird captures the slow drone.

When an edible butterfly mimics an inedible or noxious one, as is frequently the case in the tropics, the mimicker is no doubt the gainer.

It makes a big difference whether the mimicker is seeking to escape from an enemy, or seeking to deceive its prey. I fail to see how, in the latter case, any disguise of form or color could be brought about.

Our shrike, at times, murders little birds and eats out their brains, and it has not the form, or the

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color, or the eye of a bird of prey, and thus probably deceives its victims, but there is no reason to believe that this guise is the result of any sort of mimicry.

V. THE COLORS OF FRUITS

Mr. Wallace even looks upon the nuts as protectively colored, because they are not to be eaten. But without the agency of the birds and the squirrels, how are the heavy nuts, such as the chestnut, beechnut, acorn, butternut, and the like, to be scattered? The blue jay is often busy hours at a time in the fall, planting chestnuts and acorns, and red squirrels carry butternuts and walnuts far from the parent trees, and place them in forked limbs and holes for future use. Of course, many of these fall to the ground and take root. If the protective coloration of the nuts, then, were effective, it would defeat a purpose which every tree and shrub and plant has at heart, namely, the scattering of its seed. I notice that the button-balls on the sycamores are protectively colored also, and certainly they do not crave concealment. It is true that they hang on the naked trees till spring, when no concealment is possible. It is also true that the jays and the crows carry away the chestnuts from the open burrs on the trees where no color scheme would conceal them. But the squirrels find them upon the ground even beneath the snow, being guided, no doubt, by the sense of smell.

The hickory nut is almost white; why does it not

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seek concealment also? It is just as helpless as the others, and is just as sweet-meated. It occurs to me that birds can do nothing with it on account of its thick shell; it needs, therefore, to attract some four-footed creature that will carry it away from the parent tree, and this is done by the mice and the squirrels. But if this is the reason of its whiteness, there is the dusky butternut and the black walnut, both more or less concealed by their color, and yet having the same need of some creature to scatter them.

The seeds of the maple, and of the ash and the linden, are obscurely colored, and they are winged; hence they do not need the aid of any creature in their dissemination. To say that this is the reason of their dull, unattractive tints would be an explanation on a par with much that one hears about the significance of animal and vegetable coloration. Why is corn so bright colored, and wheat and barley so dull, and rice so white? No doubt there is a reason in each case, but I doubt if that reason has any relation to the surrounding animal life.

The new Botany teaches that the flowers have color and perfume to attract the insects to aid in their fertilization — a need so paramount with all plants, because plants that are fertilized by aid of the wind have very inconspicuous flowers. Is it equally true that the high color of most fruits is to attract some hungry creature to come and eat them and thus scatter the seeds? From the dwarf cornel,

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or bunch-berry, in the woods, to the red thorn in the fields, every fruit-bearing plant and shrub and tree seems to advertise itself to the passer-by in its bright hues. Apparently there is no other use to the plant of the fleshy pericarp than to serve as a bait or wage for some animal to come and sow its seed. Why, then, should it not take on these alluring colors to help along this end? And yet there comes the thought, may not this scarlet and gold of the berries and tree fruits be the inevitable result of the chemistry of ripening, as it is with the autumn foliage? What benefit to the tree, directly or indirectly, is all this wealth of color of the autumn? Many of the toadstools are highly colored also; how do they profit by it? Many of the shells upon the beach are very showy; to what end? The cherry-birds find the pale ox-hearts as readily as they do the brilliant Murillos, and the dull blue cedar berries and the duller drupes of the lotus are not concealed from them nor from the robins. But it is true that the greenish white grapes in the vineyard do not suffer from the attacks of the birds as do the blue and red ones. The reason probably is that the birds regard them as unripe. The white grape is quite recent, and the birds have not yet "caught on."

Poisonous fruits are also highly colored; to what end? In Bermuda I saw on low bushes great masses of what they called "pigeon-berries" of a brilliant yellow color and very tempting, yet I was assured

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they were poisonous. It would be interesting to know if anything eats the red berries of our wild turnip or arum. I doubt if any bird or beast could stand them. Wherefore, then, are they so brightly colored? I am also equally curious to know if anything eats the fruit of the red and white baneberry and the blue cohosh.

The seeds of some wild fruit, such as the climbing bitter-sweet, are so soft that it seems impossible they should pass through the gizzard of a bird and not be destroyed.

The fruit of the sumac comes the nearest to being a cheat of anything I know of in nature — a collection of seeds covered with a flannel coat with just a perceptible acid taste, and all highly colored. Unless the seed itself is digested, what is there to tempt the bird to devour it, or to reward it for so doing?

In the tropics one sees fruits that do not become bright colored on ripening, such as the breadfruit, the custard apple, the naseberry, the mango. And tropical foliage never colors up as does the foliage of northern trees.

VI. INSTINCT

Many false notions seem to be current in the popular mind about instinct. Apparently, some of our writers on natural history themes would like to discard the word entirely. Now instinct is not opposed to intelligence; it is intelligence of the

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unlearned, unconscious kind, — the intelligence innate in nature. We use the word to distinguish a gift or faculty which animals possess, and which is independent of instruction and experience, from the mental equipment of man which depends mainly upon instruction and experience. A man has to be taught to do that which the lower animals do from nature. Hence the animals do not progress in knowledge, while man's progress is almost limitless. A man is an animal born again into a higher spiritual plane. He has lost or shed many of his animal instincts in the process, but he has gained the capacity for great and wonderful improvement.

Instinct is opposed to reason, to reflection, to thought, — to that kind of intelligence which knows and takes cognizance of itself. Instinct is that lower form of intelligence which acts through the senses, — sense perception, sense association, sense memory, — which we share with the animals, though their eyes and ears and noses are often quicker and keener than ours. Hence the animals know only the present, visible, objective world, while man through his gift of reason and thought knows the inward world of ideas and ideal relations.

An animal for the most part knows all that it is necessary for it to know as soon as it reaches maturity; what it learns beyond that, what it learns at the hands of the animal-trainer, for instance, it learns slowly, through a long repetition of the pro-

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cess of trial and failure. Man also achieves many things through practice alone, or through the same process of trial and failure. Much of his manual skill comes in this way, but he learns certain things through the exercise of his reason; he sees how the thing is done, and the relation of the elements of the problem to one another. The trained animal never sees *how* the thing is done, it simply does it automatically, because certain sense impressions have been stamped upon it till a habit has been formed, just as a man will often wind his watch before going to bed, or do some other accustomed act, without thinking of it.

The bird builds her nest and builds it intelligently, that is, she adapts means to an end; but there is no reason to suppose that she *thinks* about it in the sense that man does when he builds his house. The nest-building instinct is stimulated into activity by outward conditions of place and climate and food supply as truly as the growth of a plant is thus stimulated.

As I look upon the matter, the most wonderful and ingenious nests in the world, as those of the weaver-birds and orioles, show no more independent self-directed and self-originated thought than does the rude nest of the pigeon or the cuckoo. They evince a higher grade of intelligent instinct, and that is all. Both are equally the result of natural promptings, and not of acquired skill, or the lack of it. One

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species of bird will occasionally learn the song of another species, but the song impulse must be there to begin with, and this must be stimulated in the right way at the right time. A caged English sparrow has been known to learn the song of the canary caged with or near it, but the sparrow certainly inherits the song impulse. One has proof of this when he hears a company of these sparrows sitting in a tree in spring chattering and chirping in unison, and almost reaching an utterance that is song-like. Our cedar-bird does not seem to have the song impulse, and I doubt if it could ever be taught to sing. In like manner our ruffed grouse has but feeble vocal powers, and I do not suppose it would learn to crow or cackle if brought up in the barn-yard. It expresses its joy at the return of spring and the mating season in its drum, as do the woodpeckers.

The recent English writer Richard Kearton says there is "no such dead level of unreasoning instinct" in the animal world as is popularly supposed, and he seems to base the remark upon the fact that he found certain of the cavities or holes in a hay-rick where sparrows roosted lined with feathers, while others were not lined. Such departures from a level line of habit as this are common enough among all creatures. Instinct is not something as rigid as cast iron; it does not invariably act like a machine, always the same. The animal is something alive, and is subject to the law of variation. Instinct may

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act more strongly in one kind than in another, just as reason may act more strongly in one man than in another, or as one animal may have greater speed or courage than another of the same species. It would be hard to find two live creatures, very far up in the scale, exactly alike. A thrush may use much mud in the construction of its nest, or it may use little or none at all; the oriole may weave strings into its nest, or it may use only dry grasses and horse-hairs; such cases only show variations in the action of instinct. But if an oriole should build a nest like a robin, or a robin build like a cliff swallow, that would be a departure from instinct to take note of.

Some birds show a much higher degree of variability than others; some species vary much in song, others in nesting and in feeding habits. I have never noticed much variation in the songs of robins, but in their nesting-habits they vary constantly. Thus one nest will be almost destitute of mud, while another will be composed almost mainly of mud; one will have a large mass of dry grass and weeds as its foundation, while the next one will have little or no foundation of the kind. The sites chosen vary still more, ranging from the ground all the way to the tops of trees. I have seen a robin's nest built in the centre of a small box that held a clump of ferns, which stood by the roadside on the top of a low post near a house, and without cover or

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shield of any sort. The robin had welded her nest so completely to the soil in the box that the whole could be lifted by the rim of the nest. She had given a very pretty and unique effect to the nest by a border of fine dark rootlets skillfully woven together. The song sparrow shows a high degree of variability both in its song and in its nesting-habits, each bird having several songs of its own, while one may nest upon the ground and another in a low bush, or in the vines on the side of your house. The vesper sparrow, on the other hand, shows a much lower degree of variability, the individuals rarely differing in their songs, while all the nests I have ever found of this sparrow were in open grassy fields upon the ground. The chipping or social sparrow is usually very constant in its song and its nesting-habits, and yet one season a chippy built her nest in an old robin's nest in the vines on my porch. It was a very pretty instance of adaptation on the part of the little bird. Another chippy that I knew had an original song, one that resembled the sound of a small tin whistle. The bush sparrow, too, is pretty constant in choosing a bush in which to place its nest, yet I once found the nest of this sparrow upon the ground in an open field with suitable bushes within a few yards of it. The woodpeckers, the jays, the cuckoos, the pewees, the warblers, and other wood birds show only a low degree of variability in song, feeding, and nesting habits.

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The Baltimore oriole makes free use of strings in its nest-building, and the songs of different birds of this species vary greatly, while the orchard oriole makes no use of strings, so far as I have observed, and its song is always and everywhere the same. Hence we may say that the lives of some birds run much more in ruts than do those of others; they show less plasticity of instinct, and are perhaps for that reason less near the state of free intelligence.

Organic life in all its forms is flexible; instinct is flexible; the habits of all the animals change more or less with changed conditions, but the range of the fluctuations in the lives of the wild creatures is very limited, and is always determined by surrounding circumstances, and not by individual volition, as it so often is in the case of man. In a treeless country birds that sing on the perch elsewhere will sing on the wing. The black bear in the Southern States "holes up" for a much shorter period than in Canada or the Rockies. Why is the spruce grouse so stupid compared with most other species? Why is the Canada jay so tame and familiar about your camp in the northern woods or in the Rockies, and the other jays so wary? Such variations, of course, have their natural explanation, whatever it may be. In New Zealand there is a parrot, the kea, that once lived upon honey and fruit, but that now lives upon the sheep, tearing its way down to the kidney fat.

This is a wide departure in instinct, but it is not

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to be read as a development of reason in its place. It is a modified instinct, — the instinct for food seeking new sources of supply. Exactly how it came about would be interesting to know. Our oriole is an insectivorous bird, but in some localities it is very destructive in the August vineyards. It does not become a fruit-eater like the robin, but a juice-sucker; it punctures the grapes for their unfermented wine. Here, again, we have a case of modified and adaptive instinct. All animals are more or less adaptive, and avail themselves of new sources of food supply. When the southern savannas were planted with rice, the bobolinks soon found that this food suited them. A few years ago we had a great visitation in the Hudson River Valley of crossbills from the north. They lingered till the fruit of the peach orchards had set, when they discovered that here was a new source of food supply, and they became very destructive to the promised crop by deftly cutting out the embryo peaches. All such cases show how plastic and adaptive instinct is, at least in relation to food supplies. Let me again say that instinct is native, untaught intelligence, directed outward, but never inward as in man.

VII. THE ROBIN

Probably, with us, no other bird is so closely associated with country life as the robin; most of the time pleasantly, but for a brief season, during

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cherry time, unpleasantly. His life touches or mingles with ours at many points — in the dooryard, in the garden, in the orchard, along the road, in the groves, in the woods. He is everywhere except in the depths of the primitive forests, and he is always very much at home. He does not hang timidly upon the skirts of our rural life, like, say, the thrasher or the chewink ; he plunges in boldly and takes his chances, and his share, and often more than his share, of whatever is going. What vigor, what cheer, how persistent, how prolific, how adaptive ; pugnacious, but cheery, pilfering, but companionable !

When one first sees his ruddy breast upon the lawn in spring, or his pert form outlined against a patch of lingering snow in the brown fields, or hears his simple carol from the top of a leafless tree at sundown, what a vernal thrill it gives one ! What a train of pleasant associations is quickened into life !

What pictures he makes upon the lawn ! What attitudes he strikes ! See him seize a worm and yank it from its burrow !

I recently observed a robin boring for grubs in a country dooryard. It is a common enough sight to witness one seize an angle-worm and drag it from its burrow in the turf, but I am not sure that I ever before saw one drill for grubs and bring the big white morsel to the surface. The robin I am speak-

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ing of had a nest of young in a maple near by, and she worked the neighborhood very industriously for food. She would run along over the short grass after the manner of robins, stopping every few feet, her form stiff and erect. Now and then she would suddenly bend her head toward the ground and bring eye or ear for a moment to bear intently upon it. Then she would spring to boring the turf vigorously with her bill, changing her attitude at each stroke, alert and watchful, throwing up the grass roots and little jets of soil, stabbing deeper and deeper, growing every moment more and more excited, till finally a fat grub was seized and brought forth. Time after time, during several days, I saw her mine for grubs in this way and drag them forth. How did she know where to drill? The insect was in every case an inch below the surface. Did she hear it gnawing the roots of the grasses, or did she see a movement in the turf beneath which the grub was at work? I know not. I only know that she struck her game unerringly each time. Only twice did I see her make a few thrusts and then desist, as if she had been for the moment deceived.

How pugnacious the robin is! With what spunk and spirit he defends himself against his enemies! Every spring I see the robins mobbing the blue jays that go sneaking through the trees looking for eggs. The crow blackbirds nest in my evergreens, and there is perpetual war between them and the robins.

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The blackbirds devour the robins' eggs, and the robins never cease to utter their protest, often backing it up with blows. I saw two robins attack a young blackbird in the air, and they tweaked out his feathers at a lively rate.

One spring a pack of robins killed a cuckoo near me that they found robbing a nest. I did not witness the killing, but I have cross-questioned a number of people who did see it, and I am convinced of the fact. They set upon him when he was on the robin's nest, and left him so bruised and helpless beneath it that he soon died. It was the first intimation I had ever had that the cuckoo devoured the eggs of other birds.

Two other well-authenticated cases have come to my knowledge of robins killing cuckoos (the black-billed) in May. The robin knows its enemies, and it is quite certain, I think, that the cuckoo is one of them.

What a hustler the robin is! No wonder he gets on in the world. He is early, he is handy, he is adaptive, he is tenacious. Before the leaves are out in April the female begins her nest, concealing it as much as she can in a tree-crotch, or placing it under a shed or porch, or even under an overhanging bank upon the ground. One spring a robin built her nest upon the ladder that was hung up beneath the eaves of the wagon-shed. Having occasion to use the ladder, we placed the nest on a box that stood beneath

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it. The robin was disturbed at first, but soon went on with her incubating in the new and more exposed position. The same spring one built her nest upon a beam in a half-finished fruit house, going out and in through the unshingled roof. One day, just as the eggs were hatched, we completed the roof, and kept up a hammering about the place till near night; the mother robin scolded a good deal, but she did not desert her young, and soon found her way in and out the door.

If a robin makes up her mind to build upon your porch, and you make up your mind that you do not want her there, there is likely to be considerable trouble on both sides before the matter is settled. The robin gets the start of you in the morning, and has her heap of dry grass and straws in place before the jealous broom is stirring, and she persists after you have cleaned out her rubbish half a dozen times. Before you have discouraged her, you may have to shunt her off of every plate or other "coign of vantage" with boards or shingles. A strenuous bird indeed, and a hustler.

VIII. THE CROW

One very cold winter's morning, after a fall of nearly two feet of snow, as I came out of my door three crows were perched in an apple tree but a few rods away. One of them uttered a peculiar caw as they saw me, but they did not fly away. It was not

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the usual high-keyed note of alarm. It may have meant "Look out!" yet it seemed to me like the asking of alms: "Here we are, three hungry neighbors of yours; give us food." So I brought out the entrails and legs of a chicken, and placed them upon the snow. The crows very soon discovered what I had done, and with the usual suspicious movement of the closed wings which has the effect of emphasizing the birds' alertness, approached and devoured the food or carried it away. But there was not the least strife or dispute among them over the food. Indeed, each seemed ready to give precedence to the others. In fact, the crow is a courtly, fine-mannered bird. Birds of prey will rend one another over their food; even buzzards will make some show of mauling one another with their wings; but I have yet to see anything of the kind with that gentle freebooter, the crow. Yet suspicion is his dominant trait. Anything that looks like design puts him on his guard. The simplest device in a cornfield usually suffices to keep him away. He suspects a trap. His wit is not deep, but it is quick, and ever on the alert.

One of our natural history romancers makes the crows flock in June. But the truth is, they do not flock till September. Through the summer the different families keep pretty well together. You may see the old ones with their young foraging about the fields, the young often being fed by their parents.

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From my boyhood I have seen the yearly meeting of the crows in September or October, on a high grassy hill or a wooded ridge. Apparently, all the crows from a large area assemble at these times; you may see them coming, singly or in loose bands, from all directions to the rendezvous, till there are hundreds of them together. They make black an acre or two of ground. At intervals they all rise in the air, and wheel about, all cawing at once. Then to the ground again, or to the tree-tops, as the case may be; then, rising again, they send forth the voice of the multitude. What does it all mean? I notice that this rally is always preliminary to their going into winter quarters. It would be interesting to know just the nature of the communication that takes place between them. Not long afterwards, or early in October, they may be seen morning and evening going to and from their rookeries. The matter seems to be settled in these September gatherings of the clan. Was the spot agreed upon beforehand and notice served upon all the members of the tribe? Our "school-of-the-woods" professors would probably infer something of the kind. I suspect it is all brought about as naturally as any other aggregation of animals. A few crows meet on the hill; they attract others and still others. The rising of a body of them in the air, the circling and cawing, may be an instinctive act to advertise the meeting to all the crows within sight or hearing. At any

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rate, it has this effect, and they come hurrying from all points.

What their various calls mean, who shall tell? That lusty *caw-aw*, *caw-aw* that one hears in spring and summer, like the voice of authority or command, what does it mean? I never could find out. It is doubtless from the male. A crow will utter it while sitting alone on the fence in the pasture, as well as when flying through the air. The crow's cry of alarm is easily distinguished; all the other birds and wild creatures know it, and the hunter who is stalking his game is apt to swear when he hears it. I have heard two crows in the spring, seated on a limb close together, give utterance to many curious, guttural, gurgling, ventriloquial sounds. What were they saying? It was probably some form of the language of love.

I venture to say that no one has ever yet heard the crow utter a complaining or a disconsolate note. He is always cheery, he is always self-possessed, he is a great success. Nothing in Bermuda made me feel so much at home as a flock of half a dozen of our crows which I saw and heard there. At one time they were very numerous on the island, but they have been persecuted till only a remnant of the tribe remains.

I

My friend and neighbor through the year,
Self-appointed overseer

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Of my crops of fruit and grain,
Of my woods and furrowed plain.

Claim thy tithings right and left,
I shall never call it theft.

Nature wisely made the law,
And I fail to find a flaw

In thy title to the earth,
And all it holds of any worth.

I like thy self-complacent air,
I like thy ways so free from care,

Thy landlord stroll about my fields,
Quickly noting what each yields;

Thy courtly mien and bearing bold,
As if thy claim were bought with gold;

Thy floating shape against the sky,
When days are calm and clouds sail high;

Thy thrifty flight ere rise of sun,
Thy homing clans when day is done.

Hues protective are not thine,
So sleek thy coat each quill doth shine.

Diamond black to end of toe,
Thy counter-point the crystal snow.

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II

Never plaintive nor appealing,
Quite at home when thou art stealing

Always groomed to tip of feather,
Calm and trim in every weather,

Morn till night my woods policing,
Every sound thy watch increasing.

Hawk and owl in tree-top hiding
Feel the shame of thy deriding.

Naught escapes thy observation,
None but dread thy accusation.

Hunters, prowlers, woodland lovers
Vainly seek the leafy covers.

III

Noisy, scheming, and predacious,
With demeanor almost gracious,

Dowered with leisure, void of hurry,
Void of fuss and void of worry,

Friendly bandit, Robin Hood,
Judge and jury of the wood,

Or Captain Kidd of sable quill,
Hiding treasures in the hill,

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Nature made thee for each season,
Gave thee wit for ample reason,

Good crow wit that 's always burnished
Like the coat her care has furnished.

May thy numbers ne'er diminish,
I'll befriend thee till life's finish.

May I never cease to meet thee,
May I never have to eat thee.

And mayest thou never have to fare so
That thou playest the part of scarecrow.

LEAF AND TENDRIL

PREFACE

As most of the essays in this volume were written in a little bark-covered study that is surrounded on all sides by vineyards, I have thought it not inappropriate for me to go to the vine for a title for the collection. The "leaf" may stand very well for the nature sketches, and the "tendril" may symbolize those other papers in which I have groped my way in some of the great problems, seeking some law or truth to cling to. The tendril is blind, but it is sensitive and outreaching, and aided by the wind, never ceases to feel this way and that for support. Whatever it touches it clings to. One vine will cling to another, or one arm cling to another arm of the same vine. It has no power to select or discriminate—its one overmastering impulse is to cling, no matter to what. Where the tendril strikes the wire, or hooks that sensitive finger around it, how quickly it tightens its hold and winds itself round and round! In time it becomes almost as hard as the wire itself.

I, too, have groped my way more or less blindly in some of the great questions that confront us in this world vineyard, and have clung to what I could find, maybe sometimes only to my own conceits or vague vaticinations.

The vines have other hints for me which I try to

PREFACE

profit by. In the mild winter days, while I am writing in my cabin study, I can hear the sharp "click, click" of Hud's shears as he trims the vines. If I could only trim my vines as heroically as Hud trims his! getting rid of all the old wood possible and leaving only a few young and vigorous shoots. The great art of grape-growing is severe trimming and high culture, and I suspect the art of literature is about the same. In the vineyard it is not foliage and wood that we are after, but grapes, and in literature verbiage and superfluities are to be kept down for the same reason — we want fruit. We have to discipline the vines severely; no riotous living, no kicking up their heels along the wires, the push of their whole life going to wood instead of grapes. At a certain time we pinch or clip the ends of all the fruit-bearing canes, cut the tendrils from the wires, chasten and humble them, and make them pause and consider. And they consider very well, for in a day or two the fruit-bunches swell perceptibly. Then later, in July, we scissor off all extra bunches, covering the ground with them, and so send the whole force of the vine into those that remain.

This is the gospel of the vine-dresser, and I would I could always make it mine when I write my essays.

January, 1908.

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LEAF AND TENDRIL

I

THE ART OF SEEING THINGS

I

I DO not purpose to attempt to tell my reader how to see things, but only to talk about the art of seeing things, as one might talk of any other art. One might discourse about the art of poetry, or of painting, or of oratory, without any hope of making one's readers or hearers poets or painters or orators.

The science of anything may be taught or acquired by study; the art of it comes by practice or inspiration. The art of seeing things is not something that may be conveyed in rules and precepts; it is a matter vital in the eye and ear, yea, in the mind and soul, of which these are the organs. I have as little hope of being able to tell the reader how to see things as I would have in trying to tell him how to fall in love or to enjoy his dinner. Either he does or he does not, and that is about all there is of it. Some people seem born with eyes in their heads, and others with buttons or painted marbles, and no amount of science can make the

I

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one equal to the other in the art of seeing things. The great mass of mankind are, in this respect, like the rank and file of an army: they fire vaguely in the direction of the enemy, and if they hit, it is more a matter of chance than of accurate aim. But here and there is the keen-eyed observer; he is the sharpshooter; his eye selects and discriminates, his purpose goes to the mark.

Even the successful angler seems born, and not made; he appears to know instinctively the ways of trout. The secret is, no doubt, love of the sport. Love sharpens the eye, the ear, the touch; it quickens the feet, it steadies the hand, it arms against the wet and the cold. What we love to do, that we do well. To know is not all; it is only half. To love is the other half. Wordsworth's poet was contented if he might enjoy the things which others understood. This is generally the attitude of the young and of the poetic nature. The man of science, on the other hand, is contented if he may understand the things that others enjoy: that is his enjoyment. Contemplation and absorption for the one; investigation and classification for the other. We probably all have, in varying degrees, one or the other of these ways of enjoying Nature: either the sympathetic and emotional enjoyment of her which the young and the artistic and the poetic temperament have, or the enjoyment through our knowing faculties afforded by natural science, or, it

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may be, the two combined, as they certainly were in such a man as Tyndall.

But nothing can take the place of love. Love is the measure of life: only so far as we love do we really live. The variety of our interests, the width of our sympathies, the susceptibilities of our hearts — if these do not measure our lives, what does? As the years go by, we are all of us more or less subject to two dangers, the danger of petrification and the danger of putrefaction; either that we shall become hard and callous, crusted over with customs and conventions till no new ray of light or of joy can reach us, or that we shall become lax and disorganized, losing our grip upon the real and vital sources of happiness and power. Now, there is no preservative and antiseptic, nothing that keeps one's heart young, like love, like sympathy, like giving one's self with enthusiasm to some worthy thing or cause.

If I were to name the three most precious resources of life, I should say books, friends, and nature; and the greatest of these, at least the most constant and always at hand, is nature. Nature we have always with us, an inexhaustible storehouse of that which moves the heart, appeals to the mind, and fires the imagination, — health to the body, a stimulus to the intellect, and joy to the soul. To the scientist Nature is a storehouse of facts, laws, processes; to the artist she is a storehouse of

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pictures; to the poet she is a storehouse of images, fancies, a source of inspiration; to the moralist she is a storehouse of precepts and parables; to all she may be a source of knowledge and joy.

II

There is nothing in which people differ more than in their powers of observation. Some are only half alive to what is going on around them. Others, again, are keenly alive: their intelligence, their powers of recognition, are in full force in eye and ear at all times. They see and hear everything, whether it directly concerns them or not. They never pass unseen a familiar face on the street; they are never oblivious of any interesting feature or sound or object in the earth or sky about them. Their power of attention is always on the alert, not by conscious effort, but by natural habit and disposition. Their perceptive faculties may be said to be always on duty. They turn to the outward world a more highly sensitized mind than other people. The things that pass before them are caught and individualized instantly. If they visit new countries, they see the characteristic features of the people and scenery at once. The impression is never blurred or confused. Their powers of observation suggest the sight and scent of wild animals; only, whereas it is fear that sharpens the one, it is love and curiosity that sharpens

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the other. The mother turkey with her brood sees the hawk when it is a mere speck against the sky; she is, in her solicitude for her young, thinking of hawks, and is on her guard against them. Fear makes keen her eye. The hunter does not see the hawk till his attention is thus called to it by the turkey, because his interests are not endangered; but he outsees the wild creatures of the plain and mountain, — the elk, the antelope, and the mountain-sheep, — he makes it his business to look for them, and his eyes carry farther than do theirs.

We may see coarsely and vaguely, as most people do, noting only masses and unusual appearances, or we may see finely and discriminately, taking in the minute and the specific. In a collection of stuffed birds, the other day, I observed that a wood thrush was mounted as in the act of song, its open beak pointing straight to the zenith. The taxidermist had not seen truly. The thrush sings with its beak but slightly elevated. Who has not seen a red squirrel or a gray squirrel running up and down the trunk of a tree? But probably very few have noticed that the position of the hind feet is the reverse in the one case from what it is in the other. In descending they are extended to the rear, the toe-nails hooking to the bark, checking and controlling the fall. In most pictures the feet are shown well drawn up under the body in both cases.

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People who discourse pleasantly and accurately about the birds and flowers and external nature generally are not invariably good observers. In their walks do they see anything they did not come out to see? Is there any spontaneous or unpremeditated seeing? Do they make discoveries? Any bird or creature may be hunted down, any nest discovered, if you lay siege to it; but to find what you are not looking for, to catch the shy winks and gestures on every side, to see all the by-play going on around you, missing no significant note or movement, penetrating every screen with your eye-beams—that is to be an observer; that is to have “an eye practiced like a blind man’s touch,”—a touch that can distinguish a white horse from a black,—a detective eye that reads the faintest signs. When Thoreau was at Cape Cod, he noticed that the horses there had a certain muscle in their hips inordinately developed by reason of the insecure footing in the ever-yielding sand. Thoreau’s vision at times fitted things closely. During some great fête in Paris, the Empress Eugénie and Queen Victoria were both present. A reporter noticed that when the royal personages came to sit down, Eugénie looked behind her before doing so, to see that the chair was really there, but Victoria seated herself without the backward glance, knowing there must be a seat ready: there always had been, and there always would be, for her. The

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correspondent inferred that the incident showed the difference between born royalty and hastily made royalty. I wonder how many persons in that vast assembly made this observation; probably very few. It denoted a gift for seeing things.

If our powers of observation were quick and sure enough, no doubt we should see through most of the tricks of the sleight-of-hand man. He fools us because his hand is more dexterous than our eye. He captures our attention, and then commands us to see only what he wishes us to see.

In the field of natural history, things escape us because the actors are small, and the stage is very large and more or less veiled and obstructed. The movement is quick across a background that tends to conceal rather than expose it. In the printed page the white paper plays quite as important a part as the type and the ink; but the book of nature is on a different plan: the page rarely presents a contrast of black and white, or even black and brown, but only of similar tints, gray upon gray, green upon green, or drab upon brown.

By a close observer I do not mean a minute, cold-blooded specialist,—

“a fingering slave,
One who would peep and botanize
Upon his mother’s grave,”—

but a man who looks closely and steadily at nature, and notes the individual features of tree and rock

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and field, and allows no subtle flavor of the night or day, of the place and the season, to escape him. His senses are so delicate that in his evening walk he feels the warm and the cool streaks in the air, his nose detects the most fugitive odors, his ears the most furtive sounds. As he stands musing in the April twilight, he hears that fine, elusive stir and rustle made by the angleworms reaching out from their holes for leaves and grasses; he hears the whistling wings of the woodcock as it goes swiftly by him in the dusk; he hears the call of the kill-dee come down out of the March sky; he hears far above him in the early morning the squeaking cackle of the arriving blackbirds pushing north; he hears the soft, prolonged, lulling call of the little owl in the cedars in the early spring twilight; he hears at night the roar of the distant waterfall, and the rumble of the train miles across the country when the air is "hollow;" before a storm he notes now distant objects stand out and are brought near on those brilliant days that we call "weather-breeders." When the mercury is at zero or lower, he notes how the passing trains hiss and simmer as if the rails or wheels were red-hot. He reads the subtle signs of the weather. The stars at night forecast the coming day to him; the clouds at evening and at morning are a sign. He knows there is the wet-weather diathesis and the dry-weather diathesis, or, as Goethe said, water affirmative

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and water negative, and he interprets the symptoms accordingly. He is keenly alive to all outward impressions. When he descends from the hill in the autumn twilight, he notes the cooler air of the valley like a lake about him; he notes how, at other seasons, the cooler air at times settles down between the mountains like a vast body of water, as shown by the level line of the fog or the frost upon the trees.

The modern man looks at nature with an eye of sympathy and love where the earlier man looked with an eye of fear and superstition. Hence he sees more closely and accurately; science has made his eye steady and clear. To a hasty traveler through the land, the farms and country homes all seem much alike, but to the people born and reared there, what a difference! They have read the fine print that escapes the hurried eye and that is so full of meaning. Every horizon line, every curve in hill or valley, every tree and rock and spring run, every turn in the road and vista in the landscape, has its special features and makes its own impression.

Scott wrote in his journal: "Nothing is so tiresome as walking through some beautiful scene with a minute philosopher, a botanist, or a pebble-gatherer, who is eternally calling your attention from the grand features of the natural picture to look at grasses and chuckie-stanes." No doubt Scott's large, generous way of looking at things

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kindles the imagination and touches the sentiments more than does this minute way of the specialist. The nature that Scott gives us is like the air and the water that all may absorb, while what the specialist gives us is more like some particular element or substance that only the few can appropriate. But Scott had his specialties, too, the specialties of the sportsman: he was the first to see the hare's eyes as she sat in her form, and he knew the ways of grouse and pheasants and trout. The ideal observer turns the enthusiasm of the sportsman into the channels of natural history, and brings home a finer game than ever fell to shot or bullet. He too has an eye for the fox and the rabbit and the migrating water-fowl, but he sees them with loving and not with murderous eyes.

III

So far as seeing things is an art, it is the art of keeping your eyes and ears open. The art of nature is all in the direction of concealment. The birds, the animals, all the wild creatures, for the most part try to elude your observation. The art of the bird is to hide her nest; the art of the game you are in quest of is to make itself invisible. The flower seeks to attract the bee and the moth by its color and perfume, because they are of service to it; but I presume it would hide from the excursionists and the picnickers if it could, because they extirpate it.

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Power of attention and a mind sensitive to outward objects, in these lies the secret of seeing things. Can you bring all your faculties to the front, like a house with many faces at the doors and windows; or do you live retired within yourself, shut up in your own meditations? The thinker puts all the powers of his mind in reflection: the observer puts all the powers of his mind in perception; every faculty is directed outward; the whole mind sees through the eye and hears through the ear. He has an objective turn of mind as opposed to a subjective. A person with the latter turn of mind sees little. If you are occupied with your own thoughts, you may go through a museum of curiosities and observe nothing.

Of course one's powers of observation may be cultivated as well as anything else. The senses of seeing and hearing may be quickened and trained as well as the sense of touch. Blind persons come to be marvelously acute in their powers of touch. Their feet find the path and keep it. They come to know the lay of the land through this sense, and recognize the roads and surfaces they have once traveled over. Helen Keller reads your speech by putting her hand upon your lips, and is thrilled by the music of an instrument through the same sense of touch. The perceptions of school-children should be trained as well as their powers of reflection and memory. A teacher in Connecticut, Miss Aiken, —

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whose work on mind-training I commend to all teachers, — has hit upon a simple and ingenious method of doing this. She has a revolving black-board upon which she writes various figures, numbers, words, sentences, which she exposes to the view of the class for one or two or three seconds, as the case may be, and then asks them to copy or repeat what was written. In time they become astonishingly quick, especially the girls, and can take in a multitude of things at a glance. Detectives, I am told, are trained after a similar method; a man is led quickly by a show-window, for instance, and asked to name and describe the objects he saw there. Life itself is of course more or less a school of this kind, but the power of concentrated attention in most persons needs stimulating. Here comes in the benefit of manual-training schools. To *do* a thing, to make something, the powers of the mind must be focused. A boy in building a boat will get something that all the books in the world cannot give him. The concrete, the definite, the discipline of real things, the educational values that lie here, are not enough appreciated.

IV

The book of nature is like a page written over or printed upon with different-sized characters and in many different languages, interlined and cross-lined, and with a great variety of marginal notes

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and references. There is coarse print and fine print; there are obscure signs and hieroglyphics. We all read the large type more or less appreciatively, but only the students and lovers of nature read the fine lines and the footnotes. It is a book which he reads best who goes most slowly or even tarries long by the way. He who runs may read some things. We may take in the general features of sky, plain, and river from the express train, but only the pedestrian, the saunterer, with eyes in his head and love in his heart, turns every leaf and peruses every line. One man sees only the migrating water-fowls and the larger birds of the air; another sees the passing kinglets and hurrying warblers as well. For my part, my delight is to linger long over each page of this marvelous record, and to dwell fondly upon its most obscure text.

I take pleasure in noting the minute things about me. I am interested even in the ways of the wild bees, and in all the little dramas and tragedies that occur in field and wood. One June day, in my walk, as I crossed a rather dry, high-lying field, my attention was attracted by small mounds of fresh earth all over the ground, scarcely more than a handful in each. On looking closely, I saw that in the middle of each mound there was a hole not quite so large as a lead-pencil. Now, I had never observed these mounds before, and my curiosity was aroused. "Here is some fine print," I said,

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“that I have overlooked.” So I set to work to try to read it; I waited for a sign of life. Presently I saw here and there a bee hovering about over the mounds. It looked like the honey-bee, only less pronounced in color and manner. One of them alighted on one of the mounds near me, and was about to disappear in the hole in the centre when I caught it in my hand. Though it stung me, I retained it and looked it over, and in the process was stung several times; but the pain was slight. I saw it was one of our native wild bees, cousin to the leaf-rollers, that build their nests under stones and in decayed fence-rails. (In Packard I found it described under the name of *Andrena*.) Then I inserted a small weed-stalk into one of the holes, and, with a little trowel I carried, proceeded to dig out the nest. The hole was about a foot deep; at the bottom of it I found a little semi-transparent, membranous sac or cell, a little larger than that of the honey-bee; in this sac was a little pellet of yellow pollen — a loaf of bread for the young grub when the egg should have hatched. I explored other nests and found them all the same. This discovery was not a great addition to my sum of natural knowledge, but it was something. Now when I see the signs in a field, I know what they mean: they indicate the tiny earthen cradles of *Andrena*.

Near by I chanced to spy a large hole in the turf, with no mound of soil about it. I could put the end

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of my little finger into it. I peered down, and saw the gleam of two small, bead-like eyes. I knew it to be the den of the wolf-spider. Was she waiting for some blundering insect to tumble in? I say she, because the real ogre among the spiders is the female. The male is small and of little consequence. A few days later I paused by this den again and saw the members of the ogress scattered about her own door. Had some insect Jack the Giant-Killer been there, or had a still more formidable ogress, the sand-hornet, dragged her forth and carried away her limbless body to her den in the bank?

What the wolf-spider does with the earth it excavates in making its den is a mystery. There is no sign of it anywhere about. Does it force its way down by pushing the soil to one side and packing it there firmly? The entrance to the hole usually has a slight rim or hem to keep the edge from crumbling in.

As it happened, I chanced upon another interesting footnote that very day. I was on my way to a muck swamp in the woods, to see if the showy lady's-slipper was in bloom. Just on the margin of the swamp, in the deep shade of the hemlocks, my eye took note of some small, unshapely creature crawling hurriedly over the ground. I stooped down, and saw it was some large species of moth just out of its case, and in a great hurry to find a suitable place in which to hang itself up and give

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its wings a chance to unfold before the air dried them. I thrust a small twig in its way, which it instantly seized upon. I lifted it gently, carried it to drier ground, and fixed the stick in the fork of a tree, so that the moth hung free a few feet from the ground. Its body was distended nearly to the size of one's little finger, and surmounted by wings that were so crumpled and stubby that they seemed quite rudimentary. The creature evidently knew what it wanted, and knew the importance of haste. Instantly these rude, stubby wings began to grow. It was a slow process, but one could see the change from minute to minute. As the wings expanded, the body contracted. By some kind of pumping arrangement air was being forced from a reservoir in the one into the tubes of the other. The wings were not really growing, as they at first seemed to be, but they were unfolding and expanding under this pneumatic pressure from the body. In the course of about half an hour the process was completed, and the winged creature hung there in all its full-fledged beauty. Its color was checked black and white like a loon's back, but its name I know not. My chief interest in it, aside from the interest we feel in any new form of life, arose from the creature's extreme anxiety to reach a perch where it could unfold its wings. A little delay would doubtless have been fatal to it. I wonder how many human geniuses are hatched whose wings are blighted

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by some accident or untoward circumstance. Or do the wings of genius always unfold, no matter what the environment may be?

One seldom takes a walk without encountering some of this fine print on nature's page. Now it is a little yellowish-white moth that spreads itself upon the middle of a leaf as if to imitate the droppings of birds; or it is the young cicadas working up out of the ground, and in the damp, cool places building little chimneys or tubes above the surface to get more warmth and hasten their development; or it is a wood-newt gorging a tree-cricket, or a small snake gorging the newt, or a bird song with some striking peculiarity — a strange defect, or a rare excellence. Now it is a shrike impaling his victim, or blue jays mocking and teasing a hawk and dropping quickly into the branches to avoid his angry blows, or a robin hustling a cuckoo out of the tree where her nest is, or a vireo driving away a cowbird, or the partridge blustering about your feet till her young are hidden. One October morning I was walking along the road on the edge of the woods, when I came into a gentle shower of butternuts; one of them struck my hat-brim. I paused and looked about me; here one fell, there another, yonder a third. There was no wind blowing, and I wondered what was loosening the butternuts. Turning my attention to the top of the tree, I soon saw the explanation: a red squirrel was at work

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gathering his harvest. He would seize a nut, give it a twist, when down it would come; then he would dart to another and another. Farther along I found where he had covered the ground with chestnut burs; he could not wait for the frost and the winds; did he know that the burs would dry and open upon the ground, and that the bitter covering of the butternuts would soon fall away from the nut?

There are three things that perhaps happen near me each season that I have never yet seen — the toad casting its skin, the snake swallowing its young, and the larvæ of the moth and butterfly constructing their shrouds. It is a mooted question whether or not the snake does swallow its young, but if there is no other good reason for it, may they not retreat into their mother's stomach to feed? How else are they to be nourished? That the moth larva can weave its own cocoon and attach it to a twig seems more incredible. Yesterday, in my walk, I found a firm, silver-gray cocoon, about two inches long and shaped like an Egyptian mummy (probably *Promethea*), suspended from a branch of a bush by a narrow, stout ribbon twice as long as itself. The fastening was woven around the limb, upon which it turned as if it grew there. I would have given something to have seen the creature perform this feat, and then incase itself so snugly in the silken shroud at the end of this tether. By swinging free, its firm, compact case was in no danger from

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woodpeckers, as it might have been if resting directly upon a branch or tree-trunk. Near by was the cocoon of another species (*Cecropia*) that was fastened directly to the limb; but this was vague, loose, and much more involved and net-like. I have seen the downy woodpecker assaulting one of these cocoons, but its yielding surface and webby interior seemed to puzzle and baffle him.

I am interested even in the way each climbing plant or vine goes up the pole, whether from right to left, or from left to right, — that is, with the hands of a clock or against them, — whether it is under the law of the great cyclonic storms of the northern hemisphere, which all move against the hands of a clock, or in the contrary direction, like the cyclones in the southern hemisphere. I take pleasure in noting every little dancing whirlwind of a summer day that catches up the dust or the leaves before me, and every little funnel-shaped whirlpool in the swollen stream or river, whether or not they spin from right to left or the reverse. If I were in the southern hemisphere, I am sure I should note whether these things were under the law of its cyclones in this respect or under the law of ours. As a rule, our twining plants and toy whirlwinds copy our revolving storms and go against the hands of the clock. But there are exceptions. While the bean, the bittersweet, the morning-glory, and others go up from left to right, the

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hop, the wild buckwheat, and some others go up from right to left. Most of our forest trees show a tendency to wind one way or the other, the hard woods going in one direction, and the hemlocks and pines and cedars and butternuts and chestnuts in another. In different localities, or on different geological formations, I find these directions reversed. I recall one instance in the case of a hemlock six or seven inches in diameter, where this tendency to twist had come out of the grain, as it were, and shaped the outward form of the tree, causing it to make, in an ascent of about thirty feet, one complete revolution about a larger tree close to which it grew. On a smaller scale I have seen the same thing in a pine.

Persons lost in the woods or on the plains, or traveling at night, tend, I believe, toward the left. The movements of men and women, it is said, differ in this respect, one sex turning to the right and the other to the left.

I had lived in the world more than fifty years before I noticed a peculiarity about the rays of light one often sees diverging from an opening, or a series of openings, in the clouds, namely, that they are like spokes in a wheel, the hub, or centre, of which appears to be just there in the vapory masses, instead of being, as is really the case, nearly ninety-three millions of miles beyond. The beams of light that come through cracks or chinks in a wall do not

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converge in this way, but to the eye run parallel to one another. There is another fact: this fan-shaped display of converging rays is always immediately in front of the observer; that is, exactly between him and the sun, so that the central spoke or shaft in his front is always perpendicular. You cannot see this fan to the right or left of the sun, but only between you and it. Hence, as in the case of the rainbow, no two persons see exactly the same rays.

The eye sees what it has the means of seeing, and its means of seeing are in proportion to the love and desire behind it. The eye is informed and sharpened by the thought. My boy sees ducks on the river where and when I cannot, because at certain seasons he thinks ducks and dreams ducks. One season my neighbor asked me if the bees had injured my grapes. I said, "No; the bees never injure my grapes."

"They do mine," he replied; "they puncture the skin for the juice, and at times the clusters are covered with them."

"No," I said, "it is not the bees that puncture the skin; it is the birds."

"What birds?"

"The orioles."

"But I have n't seen any orioles," he rejoined.

"We have," I continued, "because at this season we think orioles; we have learned by experience

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how destructive these birds are in the vineyard, and we are on the lookout for them; our eyes and ears are ready for them."

If we think birds, we shall see birds wherever we go; if we think arrowheads, as Thoreau did, we shall pick up arrowheads in every field. Some people have an eye for four-leaved clovers; they see them as they walk hastily over the turf, for they already have them in their eyes. I once took a walk with the late Professor Eaton of Yale. He was just then specially interested in the mosses, and he found them, all kinds, everywhere. I can see him yet, every few minutes upon his knees, adjusting his eye-glasses before some rare specimen. The beauty he found in them, and pointed out to me, kindled my enthusiasm also. I once spent a summer day at the mountain home of a well-known literary woman and editor. She lamented the absence of birds about her house. I named a half-dozen or more I had heard or seen in her trees within an hour — the indigo-bird, the purple finch, the yellowbird, the veery thrush, the red-eyed vireo, the song sparrow.

"Do you mean to say you have seen or heard all these birds while sitting here on my porch?" she inquired.

"I really have," I said.

"I do not see them or hear them," she replied, "and yet I want to very much."

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"No," said I; "you only *want to want* to see and hear them."

You must have the bird in your heart before you can find it in the bush.

I was sitting in front of a farmhouse one day in company with the local Nimrod. In a maple tree in front of us I saw the great crested flycatcher. I called the hunter's attention to it, and asked him if he had ever seen that bird before. No, he had not; it was a new bird to him. But he probably had seen it scores of times, — seen it without regarding it. It was not the game he was in quest of, and his eye heeded it not.

Human and artificial sounds and objects thrust themselves upon us; they are within our sphere, so to speak: but the life of nature we must meet half-way; it is shy, withdrawn, and blends itself with a vast neutral background. We must be initiated; it is an order the secrets of which are well guarded.

II

THE COMING OF SUMMER

WHO shall say when one season ends and another begins? Only the almanac-makers can fix these dates. It is like saying when babyhood ends and childhood begins, or when childhood ends and youth begins. To me spring begins when the catkins on the alders and the pussy-willows begin to swell; when the ice breaks up on the river and the first sea-gulls come prospecting northward. Whatever the date—the first or the middle or the last of March—when these signs appear, then I know spring is at hand. Her first birds—the bluebird, the song sparrow, the robin, the red-shouldered starling—are here or soon will be. The crows have a more confident caw, the sap begins to start in the sugar maple, the tiny boom of the first bee is heard, the downy woodpecker begins his resonant *tat, tat, tat*, on the dry limbs, and the cattle in the barnyard low long and loud with wistful looks toward the fields.

The first hint of summer comes when the trees are fully fledged and the nymph Shadow is born. See her cool circles again beneath the trees in the

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field, or her deeper and cooler retreats in the woods. On the slopes, on the opposite side of the river, there have been for months under the morning and noon sun only slight shadow tracings, a fretwork of shadow lines; but some morning in May I look across and see solid masses of shade falling from the trees athwart the sloping turf. How the eye revels in them! The trees are again clothed and in their right minds; myriad leaves rustle in promise of the coming festival. Now the trees are sentient beings; they have thoughts and fancies; they stir with emotion; they converse together; they whisper or dream in the twilight; they struggle and wrestle with the storm.

“Caught and cuff’d by the gale,”

Tennyson says.

Summer always comes in the person of June, with a bunch of daisies on her breast and clover blossoms in her hands. A new chapter in the season is opened when these flowers appear. One says to himself, “Well, I have lived to see the daisies again and to smell the red clover.” One plucks the first blossoms tenderly and caressingly. What memories are stirred in the mind by the fragrance of the one and the youthful face of the other! There is nothing else like that smell of the clover: it is the maidenly breath of summer; it suggests all fresh, buxom, rural things. A field of ruddy, blooming clover,

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dashed or sprinkled here and there with the snow-white of the daisies; its breath drifts into the road when you are passing; you hear the boom of bees, the voice of bobolinks, the twitter of swallows, the whistle of woodchucks; you smell wild strawberries; you see the cattle upon the hills; you see your youth, the youth of a happy farm-boy, rise before you. In Kentucky I once saw two fields, of one hundred acres each, all ruddy with blooming clover — perfume for a whole county.

The blooming orchards are the glory of May, the blooming clover-fields the distinction of June. Other characteristic June perfumes come from the honey-locusts and the blooming grapevines. At times and in certain localities the air at night and morning is heavy with the breath of the former, and along the lanes and roadsides we inhale the delicate fragrance of the wild grape. The early grasses, too, with their frostlike bloom, contribute something very welcome to the breath of June.

Nearly every season I note what I call the bridal day of summer — a white, lucid, shining day, with a delicate veil of mist softening all outlines. How the river dances and sparkles; how the new leaves of all the trees shine under the sun; the air has a soft lustre; there is a haze, it is not blue, but a kind of shining, diffused nimbus. No clouds, the sky a bluish white, very soft and delicate. It is the nuptial day of the season; the sun fairly takes the earth to

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be his own, for better or for worse, on such a day, and what marriages there are going on all about us: the marriages of the flowers, of the bees, of the birds. Everything suggests life, love, fruition. These bridal days are often repeated; the serenity and equipoise of the elements combine. They were such days as these that the poet Lowell had in mind when he exclaimed, "What is so rare as a day in June?" Here is the record of such a day, June 1, 1883: "Day perfect in temper, in mood, in everything. Foliage all out except on button-balls and celtis, and putting on its dark green summer color, solid shadows under the trees, and stretching down the slopes. A few indolent summer clouds here and there. A day of gently rustling and curtsying leaves, when the breeze almost seems to blow upward. The fields of full-grown, nodding rye slowly stir and sway like vast assemblages of people. How the chimney swallows chipper as they sweep past! The vireo's cheerful warble echoes in the leafy maples; the branches of the Norway spruce and the hemlocks have gotten themselves new light green tips; the dandelion's spheres of ethereal down rise above the grass: and now and then one of them suddenly goes down: the little chippy, or social sparrow, has thrown itself upon the frail stalk and brought it to the ground, to feed upon its seeds; here it gets the first fruits of the season. The first red and white clover heads have just opened, the

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yellow rock-rose and the sweet viburnum are in bloom; the bird chorus is still full and animated; the keys of the red maple strew the ground, and the cotton of the early everlasting drifts upon the air." For several days there was but little change. "Getting toward the high tide of summer. The air well warmed up, Nature in her jocund mood, still, all leaf and sap. The days are idyllic. I lie on my back on the grass in the shade of the house, and look up to the soft, slowly moving clouds, and to the chimney swallows disporting themselves up there in the breezy depths. No hardening in vegetation yet. The moist, hot, fragrant breath of the fields — mingled odor of blossoming grasses, clover, daisies, rye — the locust blossoms, dropping. What a humming about the hives; what freshness in the shade of every tree; what contentment in the flocks and herds! The springs are yet full and cold; the shaded watercourses and pond margins begin to draw one." Go to the top of the hill on such a morning, say by nine o'clock, and see how unspeakably fresh and full the world looks. The morning shadows yet linger everywhere, even in the sunshine; a kind of blue coolness and freshness, the vapor of dew tinting the air.

Heat and moisture, the father and mother of all that lives, when June has plenty of these, the increase is sure.

Early in June the rye and wheat heads begin to

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nod; the motionless stalks have a reflective, meditative air. A little while ago, when their heads were empty or filled only with chaff and sap, how straight up they held them! Now that the grain is forming, they have a sober, thoughtful look. It is one of the most pleasing spectacles of June, a field of rye gently shaken by the wind. How the breezes are defined upon its surface — a surface as sensitive as that of water; how they trip along, little breezes and big breezes together! Just as this glaucous green surface of the rye-field bends beneath the light tread of the winds, so, we are told, the crust of the earth itself bends beneath the giant strides of the great atmospheric waves.

There is one bird I seldom hear till June, and that is the cuckoo. Sometimes the last days of May bring him, but oftener it is June before I hear his note. The cuckoo is the true recluse among our birds. I doubt if there is any joy in his soul. "Rain-crow," he is called in some parts of the country. His call is supposed to bode rain. Why do other birds, the robin for instance, often make war upon the cuckoo, chasing it from the vicinity of their nests? There seems to be something about the cuckoo that makes its position among the birds rather anomalous. Is it at times a parasitical bird, dropping its eggs into other birds' nests? Or is there some suggestion of the hawk about our species as well as about the European? I do not know. I

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only know that it seems to be regarded with a suspicious eye by other birds, and that it wanders about at night in a way that no respectable bird should. The birds that come in March, as the bluebird, the robin, the song sparrow, the starling, build in April; the April birds, such as the brown thrasher, the barn swallow, the chewink, the water-thrush, the oven-bird, the chippy, the high-hole, the meadowlark, build in May, while the May birds, the kingbird, the wood thrush, the oriole, the orchard starling, and the warblers, build in June. The April nests are exposed to the most dangers: the storms, the crows, the squirrels, are all liable to cut them off. The midsummer nests, like that of the goldfinch and the waxwing, or cedar-bird, are the safest of all.

In March the door of the seasons first stands ajar a little; in April it is opened much wider; in May the windows go up also; and in June the walls are fairly taken down and the genial currents have free play everywhere. The event of March in the country is the first good sap day, when the maples thrill with the kindling warmth; the event of April is the new furrow and the first seeding; — how ruddy and warm the soil looks just opened to the sun! — the event of May is the week of orchard bloom; with what sweet, pensive gladness one walks beneath the pink-white masses, while long, long thoughts descend upon him! See the impetuous orioles chase

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one another amid the branches, shaking down the fragrant snow. Here the rose-breasted grosbeak is in the blooming cherry tree, snipping off the blossoms with that heavy beak of his — a spot of crimson and black half hidden in masses of white petals. This orchard bloom travels like a wave. In March it is in the Carolinas; by the middle of April its crest has reached the Potomac; a week or ten days later it is in New Jersey; then in May it sweeps through New York and New England; and early in June it is breaking upon the orchards in Canada. Finally, the event of June is the fields ruddy with clover and milk-white with daisies.

III

A BREATH OF APRIL

I

IT would not be easy to say which is our finest or most beautiful wild flower, but certainly the most poetic and the best beloved is the arbutus. So early, so lowly, so secretive there in the moss and dry leaves, so fragrant, tinged with the hues of youth and health, so hardy and homelike, it touches the heart as no other does.

April's flower offers the first honey to the bee and the first fragrance to the breeze. Modest, exquisite, loving the evergreens, loving the rocks, untamable, it is the very spirit and breath of the woods. Trailing, creeping over the ground, hiding its beauty under withered leaves, stiff and hard in foliage, but in flower like the cheek of a maiden.

One may brush away the April snow and find this finer snow beneath it. Oh, the arbutus days, what memories and longings they awaken! In this latitude they can hardly be looked for before April, and some seasons not till the latter days of the month. The first real warmth, the first tender skies, the first fragrant showers — the woods are

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flooded with sunlight, and the dry leaves and the leaf-mould emit a pleasant odor. One kneels down or lies down beside a patch of the trailing vine, he brushes away the leaves, he lifts up the blossoming sprays and examines and admires them at leisure; some are white, some are white and pink, a few are deep pink. It is enough to bask there in the sunlight on the ground beside them, drinking in their odor, feasting the eye on their tints and forms, hearing the April breezes sigh and murmur in the pines or hemlocks near you, living in a present fragrant with the memory of other days. Lying there, half dreaming, half observing, if you are not in communion with the very soul of spring, then there is a want of soul in you. You may hear the first swallow twittering from the sky above you, or the first mellow drum of the grouse come up from the woods below or from the ridge opposite. The bee is abroad in the air, finding her first honey in the flower by your side and her first pollen in the pussy-willows by the watercourses below you. The tender, plaintive love-note of the chickadee is heard here and there in the woods. He utters it while busy on the catkins of the poplars, from which he seems to be extracting some kind of food. Hawks are screaming high in the air above the woods; the plow is just tasting the first earth in the rye or corn stubble (and it tastes good). The earth looks good, it smells good, it is good. By the creek in the woods you hear the

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first water-thrush — a short, bright, ringing, hurried song. If you approach, the bird flies swiftly up or down the creek, uttering an emphatic “chip, chip.”

In wild, delicate beauty we have flowers that far surpass the arbutus: the columbine, for instance, jetting out of a seam in a gray ledge of rock, its many crimson and flame-colored flowers shaking in the breeze; but it is mostly for the eye. The spring-beauty, the painted trillium, the fringed polygala, the showy lady’s-slipper, are all more striking to look upon, but they do not quite touch the heart; they lack the soul that perfume suggests. Their charms do not abide with you as do those of the arbutus.

II

These still, hazy, brooding mid-April mornings, when the farmer first starts afield with his plow, when his boys gather the buckets in the sugar-bush, when the high-hole calls long and loud through the hazy distance, when the meadowlark sends up her clear, silvery shaft of sound from the meadow, when the bush sparrow trills in the orchard, when the soft maples look red against the wood, or their fallen bloom flecks the drying mud in the road, — such mornings are about the most exciting and suggestive of the whole year. How good the fields look, how good the freshly turned earth looks! — one could almost eat it as does the horse; — the stable manure just being drawn out and scattered

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looks good and smells good; every farmer's house and barn looks inviting; the children on the way to school with their dinner-pails in their hands — how they open a door into the past for you! Sometimes they have sprays of arbutus in their button-holes, or bunches of hepatica. The partridge is drumming in the woods, and the woodpeckers are drumming on dry limbs.

The day is veiled, but we catch such glimpses through the veil. The bees are getting pollen from the pussy-willows and soft maples, and the first honey from the arbutus.

It is at this time that the fruit and seed catalogues are interesting reading, and that the cuts of farm implements have a new fascination. The soil calls to one. All over the country, people are responding to the call, and are buying farms and moving upon them. My father and mother moved upon their farm in the spring of 1828; I moved here upon mine in March, 1874.

I see the farmers, now going along their stone fences and replacing the stones that the frost or the sheep and cattle have thrown off, and here and there laying up a bit of wall that has tumbled down.

There is rare music now in the unmusical call of the phœbe-bird — it is so suggestive.

The drying road appeals to one as it never does at any other season. When I was a farm-boy, it was about this time that I used to get out of my

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boots for half an hour and let my bare feet feel the ground beneath them once more. There was a smooth, dry, level place in the road near home, and along this I used to run, and exult in that sense of lightfootedness which is so keen at such times. What a feeling of freedom, of emancipation, and of joy in the returning spring I used to experience in those warm April twilights!

I think every man whose youth was spent on the farm, whatever his life since, must have moments at this season when he longs to go back to the soil. How its sounds, its odors, its occupations, its associations, come back to him! Would he not like to return again to help rake up the litter of straw and stalks about the barn, or about the stack on the hill where the grass is starting? Would he not like to help pick the stone from the meadow, or mend the brush fence on the mountain where the sheep roam, or hunt up old Brindle's calf in the woods, or gather oven-wood for his mother to start again the big brick oven with its dozen loaves of rye bread, or see the plow crowding the lingering snow-banks on the side-hill, or help his father break and swingle and hatchel the flax in the barnyard?

When I see a farm advertised for rent or for sale in the spring, I want to go at once and look it over. All the particulars interest me — so many acres of meadow-land, so many of woodland, so many of pasture — the garden, the orchard, the outbuild-

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ings, the springs, the creek — I see them all, and am already half in possession.

Even Thoreau felt this attraction, and recorded in his Journal: "I know of no more pleasing employment than to ride about the country with a companion very early in the spring, looking at farms with a view to purchasing, if not paying for them."

Blessed is the man who loves the soil!

III

One mid-April morning two pairs of bluebirds were in very active and at times violent courtship about my grounds. I could not quite understand the meaning of all the fuss and flutter. Both birds of each pair were very demonstrative, but the female in each case the more so. She followed the male everywhere, lifting and twinkling her wings, and apparently seeking to win him by both word and gesture. If she was not telling him by that cheery, animated, confiding, softly-endearing speech of hers, which she poured out incessantly, how much she loved him, what was she saying? She was constantly filled with a desire to perch upon the precise spot where he was sitting, and if he had not moved away, I think she would have alighted upon his back. Now and then, when she flitted away from him, he followed her with like gestures and tones and demonstrations of affection, but never with

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quite the same ardor. The two pairs kept near each other about the house, the bird-boxes, the trees, the posts and vines in the vineyard, filling the ear with their soft, insistent warbles, and the eye with their twinkling azure wings.

Was it this constant presence of rivals on both sides that so stimulated them and kept them up to such a pitch of courtship? Finally, after I had watched them over an hour, the birds began to come into collision. As they met in the vineyard, the two males clinched and fell to the ground, lying there for a moment with wings sprawled out, like birds brought down by a gun. Then they separated, and each returned to his mate, warbling and twinkling his wings. Very soon the females clinched and fell to the ground and fought savagely, rolling over and over each other, clawing and tweaking and locking beaks and hanging on like bull terriers. They did this repeatedly; once one of the males dashed in and separated them, by giving one of the females a sharp tweak and blow. Then the males were at it again, their blue plumage mixing with the green grass and ruffled by the ruddy soil. What a soft, feathery, ineffectual battle it seemed in both cases; no sound, no blood, no flying feathers, just a sudden mixing up and general disarray of blue wings and tails and ruddy breasts, there on the ground; assault but no visible wounds; thrust of beak and grip of claw, but no feather

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loosened and but little ruffling; long holding of one down by the other, but no cry of pain or fury. It was the kind of battle that one likes to witness. The birds usually locked beaks, and held their grip half a minute at a time. One of the females would always alight by the struggling males and lift her wings and utter her soft notes, but what she said — whether she was encouraging one of the blue coats or berating the other, or imploring them both to desist, or egging them on — I could not tell. So far as I could understand her speech, it was the same as she had been uttering to her mate all the time.

The language of birds is so limited that one cannot always tell their love-calls from their battle-cries. I recognize three notes in the bluebird — a simple, plaintive call uttered in the air by the migrating birds, both fall and spring, which is like the word “pure,” “pure;” then the animated warbling calls and twitterings, during the mating season, which are uttered in a fond, reassuring tone, usually accompanied by that pretty wing gesture; then the call of alarm when some enemy approaches the nest or a hawk appears.

This last note is soft like the others, but the tone is different; it is sorrowful and apprehensive. Most of our song birds have these three notes expressive of love, alarm, and fellowship. The last-named call seems to keep them in touch with one another. I might perhaps add to this list the scream of distress

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which most birds utter when caught by a cat or a hawk — the voice of uncontrolled terror and pain, which is nearly the same in all species — dissonant and piercing. The other notes and calls are characteristic, but this last is the simple screech of common terrified nature.

When my bluebirds dashed at each other with beak and claw, their preliminary utterances had to my ears anything but a hostile sound. Indeed, for the bluebird to make a harsh, discordant sound seems out of the question. Once, when the two males lay upon the ground with outspread wings and locked beaks, a robin flew down by them and for a moment gazed intently at the blue splash upon the grass, and then went his way.

As the birds drifted about the grounds, first the males, then the females rolling on the grass or in the dust in fierce combat, and between times the members of each pair assuring each other of undying interest and attachment, I followed them, apparently quite unnoticed by them. Sometimes they would lie more than a minute upon the ground, each trying to keep his own or to break the other's hold. They seemed so oblivious of everything about them that I wondered if they might not at such times fall an easy prey to cats and hawks. Let me put their watchfulness to the test, I said. So, as the two males clinched again and fell to the ground, I cautiously approached them, hat in hand. When

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ten feet away and unregarded, I made a sudden dash and covered them with my hat. The struggle continued for a few seconds under there, then all was still. Sudden darkness had fallen upon the field of battle. What did they think had happened? Presently their heads and wings began to brush the inside of my hat. Then all was still again. Then I spoke to them, called to them, exulted over them, but they betrayed no excitement or alarm. Occasionally a head or a body came in gentle contact with the top or the sides of my hat.

But the two females were evidently agitated by the sudden disappearance of their contending lovers, and began uttering their mournful alarm-note. After a minute or two I lifted one side of my hat and out darted one of the birds; then I lifted the hat from the other. One of the females then rushed, apparently with notes of joy and congratulation, to one of the males, who gave her a spiteful tweak and blow. Then the other came and he served her the same. He was evidently a little bewildered, and not certain what had happened or who was responsible for it. Did he think the two females were in some way to blame? But he was soon reconciled to one of them again, as was the other male with the other, yet the two couples did not separate till the males had come in collision once more. Presently, however, they drifted apart, and each pair was soon holding an animated con-

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versation, punctuated by those pretty wing gestures, about the two bird-boxes.

These scenes of love and rivalry had lasted nearly all the forenoon, and matters between the birds apparently remained as they were before — the members of each pair quite satisfied with each other. One pair occupied one of the bird-boxes in the vineyard and reared two broods there during the season, but the other pair drifted away and took up their abode somewhere else.

If they had come to an understanding, why this continued demonstration and this war between them? The unusual thing was the interest and the activity of the females. They outdid the males in making love and in making war. With most species of our birds, the females are quite indifferent to the blandishments of the males, if they are not actually bored by them. They flee from them, or spitefully resent their advances. In April a female robin may often be seen fighting off three or four of her obstreperous admirers, as if every feminine sentiment she possessed had been outraged.

But the bluebird is an exception; the female is usually very responsive, but only in the instance above related have I seen her so active in the courtship.

IV

A WALK IN THE FIELDS

LET us go and walk in the fields. It is the middle of a very early March — a March that has in some way cut out April and got into its place.

I knew an Irish laborer, who during his last illness thought, when spring came, if he could walk in the fields, he would get well. I have observed that farmers, when harassed by trouble, or weighed down by grief, are often wont to go and walk alone in the fields. They find dumb sympathy and companionship there. I knew a farmer who, after the death of his only son, would frequently get up in the middle of the night and go and walk in his fields. It was said that he had been harsh and unjust to his son, and, during the last day the latter had worked and when the fatal illness was coming upon him, the father had severely upbraided him because he left his task and sat for a while under the fence. One can fancy him going to this very spot in his midnight wanderings, and standing in mute agony where the cruel words had been spoken, or throwing himself upon the ground, pleading in vain at the door of the irrevocable past. That door

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never opens again, plead you there till your heart breaks.

A farmer's fields become in time almost a part of himself; his life history is written all over them; virtue has gone out of himself into them; he has fertilized them with the sweat of his brow; he knows the look and the quality of each one. This one he reclaimed from the wilderness when he came on the farm as a young man; he sowed rye among the stumps and scratched it in with a thorn brush; as the years went by he saw the stumps slowly decay; he would send his boys to set fire to them in the dry spring weather; — I was one of those boys, and it seems as if I could smell the pungent odor of those burning stumps at this moment: now this field is one of his smoothest, finest meadows. This one was once a rough pasture; he pried up or blasted out the rocks, and with his oxen drew them into a line along the border of the woods, and with stone picked or dug from the surface built upon them a solid four-foot wall; now the mowing-machine runs evenly where once the cattle grazed with difficulty.

I was a boy when that field was cleaned up. I took a hand — a boy's hand — in the work. I helped pick up the loose stone, which we drew upon a stone-boat shod with green poles. It was back-aching work, and it soon wore the skin thin on the ends of the fingers. How the crickets and ants and beetles would rush about when we uncovered them! They no doubt

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looked upon the stone that sheltered them as an old institution that we had no right to remove. No right, my little folk, only the might of the stronger. Sometimes a flat stone would prove the roof of a mouse-nest — a blinking, bead-eyed, meadow-mouse. What consternation would seize him, too, as he would rush off along the little round beaten ways under the dry grass and weeds! Many of the large bowlders were deeply imbedded in the soil, and only stuck their noses or heads, so to speak, up through the turf. These we would first tackle with the big lever, a long, dry, ironwood pole, as heavy as one could handle, shod with a horseshoe. With the end of this thrust under the end or edge of a bowlder, and resting upon a stone for a fulcrum, we would begin the assault. Inch by inch the turf-bound rock would yield. Sometimes the lever would slip its hold, and come down upon our heads if we were not watchful. As the rock yielded, the lever required more bait, as the farmer calls it, — an addition to the fulcrum. After the rock was raised sufficiently, we would prop it up with stones, arrange a skid or skids under it — green beech poles cut in the woods — wrap a chain around it, and hitch the oxen to it, directing them to the right or left to turn the bowlder out of its bed and place it on the surface of the ground. When this was accomplished, then came the dead straight pull to the line of the fence. An old, experienced ox-team know what is before them, or

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rather behind them; they have felt the bowlder and sized it up. At the word and the crack of the whip they bend their heads and throw their weight upon the yoke. Now the hickory bows settle into their shoulders, they kink their tails and hump their backs, their sharp hoofs cut the turf, and the great inert mass moves. Tearing up the sod, grinding over stones, the shouts of the excited driver urging them on, away they go toward the line. The peculiar and agreeable odor of burnt and ground stone arises from the rear. Only a few yards at a time; how the oxen puff as they halt to take breath and lap their tongues out over their moist muzzles! Then they bend to the work again, the muscular effort reaching their very tails. Thus the work goes on for several days or a week, till the row of bottom rocks is complete. If there are others remaining in the field, then the row is doubled up till the land is cleaned.

What a torn and wounded appearance that section of ground presents, its surface everywhere marked with red stripes or bands, each ending in or starting from a large and deep red cavity in the sward! But soon the plow will come, equalizing and obliterating and writing another history upon the page.

There is something to me peculiarly interesting in stone walls — a kind of rude human expression to them, suggesting the face of the old farmer him-

A WALK IN THE FIELDS

self. How they climb the hills and sweep through the valleys. They decay not, yet they grow old and decrepit; little by little they lose their precision and firmness, they stagger, then fall. In a still, early spring morning or April twilight one often hears a rattle of stones in a distant field; some bit of old wall is falling. The lifetime of the best of them is rarely threescore and ten. The other day, along the highway, I saw an old man relaying a dilapidated stone wall. "Fifty-three years ago," he said, "I laid this wall. When it is laid again, I shan't have the job." It is rarely now that one sees a new wall going up. The fences have all been built, and the farmer has only to keep them in repair.

When you build a field or a highway wall, do not make the top of it level across the little hollows; let it bend to the uneven surface, let it look flexible and alive. A foundation wall, with its horizontal lines, looks stiff and formal, but a wall that undulates along like a live thing pleases the eye.

When I was a boy upon the old farm, my father always "laid out" to build forty or fifty rods of new wall, or rebuild as many rods of old wall, each spring. It is true husbandry to fence your field with the stones that incumber it, to utilize obstacles. The walls upon the old farm of which I am thinking have each a history. This one, along the lower side of the road, was built in '46. I remember the man who laid it. I even remember something of

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the complexion of the May days when the work was going on. It was built from a still older wall, and new material added. It leans and staggers in places now like an old man, but it is still a substantial fence. This one upon the upper side of the road, my father told me he built the year he came upon the farm, which was in '28. He paid twenty cents a rod for having it laid to a man whose grandchildren are now gray-haired men. The wall has a rock foundation, and it still holds its course without much wavering.

The more padding there is in a stone wall, the less enduring it is. Let your stone reach clean through. A smooth face will not save it; a loose and cobbly interior will be its ruin. Let there be a broad foundation, let the parts be well bound together, let the joints be carefully broken, and, above all, let its height not be too great for its width. If it is too high, it will topple over; if its interior is defective, it will spread and collapse. Time searches out its every weakness, and respects only good material and good workmanship.

GAY PLUMES AND DULL

I

NOT long since, one of our younger naturalists sent me a photograph of a fawn in a field of daisies, and said that he took the picture to show what he considered the protective value of the spots. The white spots of the fawn did blend in with the daisies, and certainly rendered the fawn less conspicuous than it would have been without them, but I am slow to believe that the fawn has spots that it may the better hide in a daisy-field, or, in fact, anywhere else, or that the spots have ever been sufficiently protective to have materially aided in the perpetuity of the deer species. What use they have, if any, I do not know, any more than I know what use the spots on the leopard or the giraffe have, or the stripes on the zebra. I can only conjecture concerning their use. The panther does not have spots, and seems to get along just as well without them. The young of the moose and the caribou and the pronghorn are not spotted, and yet their habitat is much the same as that of the deer.

Why some forest animals are uniformly dark

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colored, while others are more or less brilliantly striped or spotted, is a question not easily answered. It is claimed that spotted and striped species are more diurnal in their habits, and frequent bushes and open glades, while the dusky species are more nocturnal, and frequent dense thickets. In a general way this is probably true. A dappled coat is more in keeping with the day than with the night, and with bushes and jungles rather than with plains or dense forests. But whether its protective value, or the protective value of the dusky coat, is the reason for its being, is another question.

This theory of the protective coloration of animals has been one of the generally accepted ideas in all works upon natural history since Darwin's time. It assumes that the color of an animal is as much the result of natural selection as any part of its structure — natural selection picking out and preserving those tints that were the most useful in concealing the animal from its enemies or from its prey. If in this world no animal had ever preyed upon another, it is thought that their colors might have been very different, probably much more bizarre and inharmonious than they are at present.

Now I am not going to run amuck upon this generally accepted theory of modern naturalists, but I do feel disposed to shake it up a little, and to see, if I can, what measure of truth there is in it. That there is a measure of truth in it I am con-

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vinced, but that it has been greatly overworked in our time, and that more has been put upon it than it can bear, of this also I am convinced.

I think we are safe in saying that a bird is protectively colored when the color, as it were, strikes in, and the bird itself acts upon the theory that it is in a measure hidden behind its assimilative plumage. This is true of nearly all the grouse tribe. These birds seem instinctively to know the value of their imitative tints, and are tame or wild according as their tints do or do not match the snow on the ground. The snow keeps the secrets of the snow, and the earth keeps the secrets of the earth, but each tells upon the other. Sportsmen tell me that quail will not "lay" when there is snow upon the ground. The snow gives them away; it lights up their covers in the weeds and the bog as with a lamp. At other times the quail will "lay" till the hunter almost steps upon them. His dog sometimes picks them up. What is the meaning of this behavior but that the bird feels hidden in the one case and not in the other? Moreover, the grouse are all toothsome; and this fact of the toothsome-ness of some birds and the toughness and unsavoriness of others, such as the woodpecker, the crow tribe, gulls, divers, cormorants, and the like, has undoubtedly played some part in their natural history. But whether they are dull-colored because they are toothsome, or toothsome because they are dull-

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colored — who shall say? Which was first, the sweetness or the color? The flesh of the quail and the partridge having become very delectable and much sought after by many wild creatures, did Nature make compensation by giving them their assimilative plumage? or were the two facts inseparable from the first? Yet the flesh of the peacock is said to be as delicate as that of the turkey.

The sweetness of an animal's flesh is doubtless determined by its food. I believe no one eats the Western road-runner, though it is duller of color than the turkey. Its food is mice, snakes, lizards, centipedes, and other vermin.

Thus far I can follow the protective-colorists, but not much farther.

Wallace goes to the extent of believing that even nuts are protectively colored because they are not to be eaten. But without the agency of birds and the small rodents, the wingless nuts, such as chestnuts, acorns, hickory nuts, and butternuts, could never get widely scattered; so that if they were effectively concealed by their colors, this fact would tend to their extinction.

If the colors of animals were as vital a matter, and the result of the same adaptive and selective process, as their varied structures, which Darwin and Wallace teach, then it would seem to follow that those of the same habits and of the same or similar habitat would be similar or identical in

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color, which is not commonly the case. Thus among the birds, the waders all have long legs and long necks, but they are not all of the same color. The divers all have short legs placed in the rear, but they vary greatly in color-markings. How greatly the ducks differ in coloration, though essentially the same in structure! Our tree warblers are of all hues and combinations of hues, though so alike in habit and form. The painted bunting in the Southwest is gaudily colored, while its congeners are all more plainly dressed.

In England the thrush that answers to our robin, being almost identical in form, manner, and habit, is black as a coal. The crow tribe are all built upon the same plan, and yet they show a very great diversity of colors. Why is our jay so showily colored, and the Canada jay so subdued in tint?

The hummingbirds do not differ much in their anatomy, but their tints differ as much as do those of precious stones. The woodpeckers show a variety of markings that cannot be accounted for upon any principle of utility or of natural selection. Indeed, it would seem as if in the colors of birds and mammals Nature gave herself a comparatively free hand, not being bound by the same rigid necessity as in their structures. Within certain limits, something like caprice or accident seems to prevail. The great law of assimilation, or harmonious blending, of which I shall presently have more to say, goes on,

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but it is checked and thwarted and made sport of by other tendencies.

Then the principle of coloration of the same species does not always hold good in different parts of the earth. Our northern flycatchers are all of dull plumage, but in Mexico we find the vermilion flycatcher, with under parts of bright scarlet, and in Java is a flycatcher like a flame of fire. With us, as soon as a bird touches the ground it takes on some ground colors. All our ground-feeders are more or less ground-tinted. But in the East this is not to the same extent true. Thus our pigeons and doves are blue-gray and buff. In the Molucca Islands there is a blue and purple dove, and one species with coppery green plumage, a snow-white tail, and snow-white pendent feathers on the neck. Our thrushes are ground-feeders and are ground-colored. The ground thrushes of the Malay Archipelago are much more brilliantly marked. One species has the "upper parts soft green, the head jet black, with a stripe of blue and brown over the eye; at the base of the tail and on the shoulders are bands of bright silvery blue, and the under-sides are of delicate buff with a stripe of rich crimson bordered with black on the belly." Another ground thrush is velvety black above, relieved by a breast of pure white, shoulders of azure blue, and belly of vivid crimson — one of the most beautiful birds of the East, Wallace says. The Eastern kingfishers are

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also much more brilliant than ours. Our gallinaeous birds are all dull neutral-tinted, but look at this family of birds in the Orient, brilliant beyond words to paint! In Africa the sand grouse is brilliantly marked. There are also snow-white herons in Africa, and black and white ibises. On the Aru Islands in the Malay Archipelago is a flycatcher that is brilliant black and bright orange.

In our hemisphere the swans are white, the pigeons are blue, and the parrots are green. In Australia the swans are black, and there is a black pigeon and a black parrot. In the desert of Sahara most of the birds are desert-colored, but there are some that are blue, and others that are black or brown and white. It is said that the Arctic fox, which is snow-white in most other places, remains blue all winter in Iceland. No doubt there are reasons for all these variations, but whatever these reasons are, they do not seem to favor the theory of protective coloration.

The more local an animal is, the more its color assimilates with its surroundings; or perhaps I should say, the more uniform its habitat, the more assimilative its coloring. The valley quail of California frequents trees and roosts in trees, hence its coloring is not copied from the ground. It is darker and bluer than our Bob White.

Nature dislikes incongruities, and permits them under protest. The fleet rabbit with eyes ever open

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is as protectively colored as the toad or the tortoise. The porcupine with his armor of quills is as hidden from the eye as the coon, or the woodchuck, or the prairie-dog. Climbing things are as well hidden as creeping things, the mole in the ground as well as the mouse on the surface, the squirrel that flies as well as the squirrel that runs, creatures of the night as well as creatures of the day, the elephant, the rhinoceros, the hippopotamus, as well as the smaller animals that are preyed upon. If birds are colored to conceal them from hawks, why are the wild boar, the deer, the hare, similarly colored? They are not hiding from hawks; their enemies go by scent. The hippopotamus in the Nile is as protectively colored as the camel on the sands, and yet in neither case can protection be the end sought. In Africa there is a white rhinoceros. Behold our mountain goat nearly as white as snow against the dark background of the rocks and mountain-slopes where he lives, and yet he appears to thrive as well as the protectively-colored deer. Does not the lion without stripes fare just as well as the tiger with? Does not our vermilion flycatcher fare just as well as its cousins of duller plumes? Does not the golden pheasant fare as well as the protectively colored grouse? Everywhere the creative energy seems to have its plain, modest moods and its gaudy, bizarre moods, both in the vegetable and the animal worlds. Why are some flowers so gaudy and others

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so plain, some so conspicuous and others so hidden, some insects so brilliant and others so dull, some fruits so highly colored and others so neutral? This law of endless variation is no doubt at the bottom of all these things. The bird has varied in color from its parent, and as the variation has not told against it, it has gone on and intensified. So with the flowers. I don't believe cherries are red or black to attract the birds, or plums blue. Poisonous berries are as brilliant as harmless ones. No doubt there is a reason for all these high colors, and for the plain ones, if we could only find it. Of course, food, environment, climate, have much to do with it all.

Probably, if we could compare the food which our grouse eats with that which the brilliant pheasants of the East eat, or the food of our wild turkey with that of the Central American bird, or of our pigeons with those of the Malay Archipelago, we might hit upon some clue to their difference of coloration. The strange and bizarre colors and forms of the birds of Africa compared with those of North America or of Europe may be a matter of food. Why our flicker is brighter colored than our other woodpeckers may be on account of the ants he eats.

Mr. Wallace in one of his essays points out the effect of locality on color, many species of unrelated genera both among insects and among birds being marked similarly, with white or yellow or black.

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as if from the effect of some fashion that has spread among them. In the Philippine Islands metallic hues are the fashion; in some other islands very light tints are in vogue; in still other localities unrelated species favor crimson or blue. Mr. Wallace says that among the various butterflies of different countries this preference for certain colors is as marked as it would be if the hares, marmots, and squirrels of Europe were all red with black feet, while the corresponding species of Central Asia were all yellow with black heads, or as it would be if our smaller mammals, the coon, the possum, the squirrels, all copied the black and white of the skunk. The reason for all this is not apparent, though Wallace thinks that some quality of the soil which affects the food may be the cause. It is like the caprice of fashion. In fact, the exaggerated plumes, fantastic colors, and monstrous beaks of many birds in both hemispheres have as little apparent utility, and seem to be quite as much the result of caprice, as are any of the extreme fashions in dress among human beings.

Our red-shouldered starlings flock in the fall, and they are not protectively colored, but the bobolinks, which also flock at the same time, do then assume neutral tints. Why the change in the one case and not in the other, since both species feed in the brown marshes? Most of our own ground birds are more or less ground-colored; but here on the ground, amid

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the bushes, with the brown oven-bird and the brown thrasher, is the chewink with conspicuous markings of white and black and red. Here are some of the soft gray and brown tinted warblers nesting on the ground, and here is the more conspicuous striped black and white creeping warbler nesting by their side. Behold the rather dull-colored great crested flycatcher concealing its nest in a hollow limb, and its congener the brighter-feathered king-bird building its nest openly on the branch above.

Hence, whatever truth there may be in this theory of protective coloration, one has only to look about him to discover that it is a matter which Nature does not have very much at heart. She plays fast and loose with it on every hand. Now she seems to set great store by it, the next moment she discards it entirely.

If dull colors are protective, then bright colors are non-protective or dangerous, and one wonders why all birds of gay feather have not been cut off and the species exterminated: or why, in cases where the males are bright-colored and the females of neutral tints, as with our scarlet tanager and indigo-bird, the females are not greatly in excess of the males, which does not seem to be the case.

II

We arrive at the idea that neutral tints are protective from the point of view of the human eye

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Now if all animals that prey upon others were guided by the eye alone, there would be much more in the theory than there is. But none of the predaceous four-footed beasts depend entirely upon the eye. The cat tribe does to a certain extent, but these creatures stalk or waylay moving game, and the color does not count. A white hare will evidently fall a prey to a lynx or a cougar in our winter woods as easily as a brown rabbit; and will not a desert-colored animal fall a prey to a lion or a tiger just as readily as it would if it were white or black? Then the most destructive tribes of all, the wolves, the foxes, the minks, the weasels, the skunks, the coons, and the like, depend entirely upon scent. The eye plays a very insignificant part in their hunting, hence again the question of color is eliminated.

Birds of prey depend upon the eye, but they are also protectively colored, and their eyes are so preternaturally sharp that no disguise of assimilative tints is of any avail against them. If both the hunted and its hunter are concealed by their neutral tints, of what advantage is it to either? If the brown bird is hidden from the brown hawk, and *vice versa*, then are they on an equal footing in this respect, and the victory is to the sharpest-eyed. If, as is doubtless the case, the eye of the hawk sharpens as the problem of his existence becomes more difficult, then is the game even, and the quarry

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has no advantage — the protective color does not protect.

Why should the owl, which hunts by night, be colored like the hawk that hunts by day? If the owl were red, or blue, or green, or black, or white, would it not stand just as good a chance of obtaining a subsistence? Its silent flight, its keenness of vision, and the general obscurity are the main matters. At night color is almost neutralized. Would not the lynx and the bobcat fare just as well if they were of the hue of the sable or the mink? Are their neutral grays or browns any advantage to them? The gray fox is more protectively colored than the red; is he therefore more abundant? Far from it; just the reverse is true. The same remark applies to the red and the gray squirrels.

The northern hare, which changes to white in winter, would seem to have an advantage over the little gray rabbit, which is as conspicuous upon the snow as a brown leaf, and yet such does not seem to be the case. It is true that the rabbit often passes the day in holes and beneath rocks, and the hare does not; but it is only at night that the natural enemies of each — foxes, minks, weasels, wildcats, owls — are abroad.

It is thought by Wallace and others that the skunk is strikingly marked as a danger signal, its contrast of black and white warning all creatures to pass by on the other side. But the magpie is

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marked in much the same way, as is also our bobolink, which, in some localities, is called "the skunk-bird," and neither of these birds has any such reason to advertise itself as has the skunk. Then here is the porcupine, with its panoply of spears, as protectively colored as the coon or the woodchuck, — why does not it have warning colors also? The enemy that attacks it fares much worse than in the case of its black and white neighbor.

The ptarmigan is often cited as a good illustration of the value of protective coloration, — white in winter, particolored in spring, and brown in summer, — always in color blending with its environment. But the Arctic fox would not be baffled by its color; it goes by scent; and the great snowy owl would probably see it in the open at any time of year. On islands in Bering Sea we saw the Arctic snowbird in midsummer, white as a snowflake, and visible afar. Our northern grouse carry their gray and brown tints through our winters, and do not appear to suffer unduly from their telltale plumage. If the cold were as severe as it is farther north, doubtless they, too, would don white coats, for the extreme cold seems to play an important part in this matter, — this and the long Arctic nights. Sir John Ross protected a Hudson's Bay lemming from the low temperature by keeping it in his cabin, and the animal retained its summer coat; but when he exposed it to a temperature of thirty degrees below

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zero, it began to change to white in a single night, and at the end of a week was almost entirely so. It is said that in Siberia domestic cattle and horses become lighter-colored in the winter, and Darwin says he has known brown ponies in England to become white during the same season.

Only one of our weasels, the ermine, becomes white in winter; the others keep their brown coats through the year. Is this adaptive color any advantage to the ermine? and are the other weasels handicapped by their brown tints?

The marten, the sable, and the fisher do not turn white in the cold season, nor the musk ox, nor the reindeer. The latter animals are gregarious, and the social spirit seems to oppose local color.

Apart from the intense cold, the long Arctic nights no doubt have much to do with the white of Arctic animals. "Absence of light leads to diminution or even total abolition of pigmentation, while its presence leads to an increase in some degree proportionate to the intensity of the light."¹

When the variable northern hare is removed to a milder climate, in the course of a few years it ceases to turn white in winter.

The more local an animal is, the more does it incline to take on the colors of its surroundings, as may be seen in the case of the toads, the frogs, the snakes, and many insects. It seems reasonable

¹ Vernon on *Variation in Animals and Plants*.

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that the influence of the environment should be more potent in such cases. The grasshoppers in the fields are of all shades of green and brown and gray, but is it probable that these tints ever hide them from their natural enemies — the sharp-eyed birds and fowls? A grasshopper gives itself away when it hops, and it always hops. On the sea-coast I noticed that the grasshoppers were gray like the sands. What fed upon them, if anything, I could not find out, but their incessant hopping showed how little they sought concealment. The nocturnal enemies of grasshoppers, such as coons and skunks, are probably not baffled at all by their assimilative colors.

Our wood-frog (*Rana sylvatica*) is found throughout the summer on the dry leaves in the woods, and it is red like them. When it buries itself in the leaf mould in the fall for its winter sleep, it turns dark like the color of the element in which it is buried. Can this last change be for protection also? No enemy sees it or disturbs it in that position, and yet it is as “protectively” colored as in summer. This is the stamp of the environment again.

The toad is of the color of the ground where he fumbles along in the twilight or squats by day, and yet, I fancy, his enemy the snake finds him out without difficulty. He is of the color of the earth because he is of the earth earthy, and the bullfrog is of the color of his element, — but there are the

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little green frog, and the leopard frog, and the pickerel frog, all quite showily marked. So there we are, trying to tabulate Nature when she will not be tabulated! Whether it be the phrase "protective coloration," or the imprint of the environment, with which we seek to capture her, she will not always be captured. In the tropics there are gaudily colored tree-frogs, — blue, yellow, striped, — frogs with red bodies and blue legs, and these showy creatures are never preyed upon, they are uneatable. But the old question comes up again — are the colors to advertise their uneatableness, or are they the necessary outcome, and would they be the same in a world where no living thing was preyed upon by another? The acids or juices that make their flesh unpalatable may be the same that produce the bright colors. To confound the cause with the effect is a common error. I doubt if the high color of some poisonous mushrooms is a warning color, or has any reference to outward conditions. The poison and the color are probably inseparable.

The muskrat's color blends him with his surroundings, and yet his enemies, the mink, the fox, the weasel, trail him just the same; his color does not avail. The same may be said of the woodchuck. What color could he be but earth color? and yet the wolf and the fox easily smell him out. If he were snow-white or jet-black (as he sometimes is), he would be in no greater danger.

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I think it highly probable that our bluebird is a descendant of a thrush. The speckled breast of the young bird indicates this, as does a thrush-like note which one may occasionally hear from it. The bird departed from the protective livery of the thrush and came down its long line of descent in a showy coat of blue, and yet got on just as well as its ancestors. Gay plumes were certainly no handicap in this case. Are they in any case? I seriously doubt it. In fact, I am inclined to think that if the birds and the mammals of the earth had been of all the colors of the rainbow, they would be just about as numerous.

The fact that this assimilative coloring disappears in the case of animals under domestication, — that the neutral grays and browns are followed by white and black and particolored animals, — what does that prove? It proves only that the order of Nature has been interfered with, and that as wild instinct becomes demoralized under domestication, so does the wild coloration of animals. The conditions are changed, numberless new influences are brought to bear, the food is changed and is of greater variety, climatic influences are interfered with, multitudes of new and strange impressions are made upon each individual animal, and Nature abandons her uniformity of coloration and becomes reckless, so to speak, not because the pressure of danger is removed, but because the danger is of a

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new and incalculable kind — the danger from man and artificial conditions. Man demoralizes Nature whenever he touches her, in savage tribes and in animal life, as well as in the fields and woods. He makes sharp contrasts wherever he goes, in forms, in colors, in sounds, in odors, and it is not to be wondered at that animals brought under his influence come in time to show, more or less, these contrasts. The tendency to variation is stimulated; form as well as color is rapidly modified; the old order is broken up, and the animal comes to partake more or less of the bizarre condition that surrounds it. Nature when left to herself is harmonious; man makes discords, or harmony of another order. The instincts of wild animals are much more keen and invariable than are those of animals in domestication, the conditions of their lives being far more rigid and exacting. Remove the eggs from a wild bird's nest and she instantly deserts it; but a domestic fowl will incubate an empty nest for days. For the same reason the colors of animals in domestication are less constant than in the wild state; they break up and become much more bizarre and capricious.

Cultivated plants depart more from a fixed type than do plants of the fields and the woods. See what *outré* forms and colors the cultivated flowers display!

The pressure of fear is of course much greater

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upon the wild creatures than upon the tame, but that the removal or the modification of this should cause them to lose their neutral tints is not credible. The domestic pigeons and the barnyard fowls are almost as much exposed to their arch enemy, the hawk, as is the wild pigeon or the jungle fowl, if not more, since the wild birds are free to rush to the cover of the trees and woods. And how ceaseless their vigilance! what keen eyes they have for hawks, whether they circle in the air or walk about in the near fields! In fact, the instinct of fear of some enemy in the air above has apparently not been diminished in the barnyard fowls by countless generations of domestication. Let a boy shy a rusty pie-tin or his old straw hat across the henyard, and behold what a screaming and a rushing to cover there is! This ever watchful fear on the part of the domestic fowls ought to have had some effect in preserving their neutral tints, but it has not. A stronger influence has come from man's disruption of natural relations.

Why are ducks more variously and more brilliantly colored than geese? I think it would be hard to name the reason. A duck seems of a more intense nature than a goose, more active, more venturesome; it takes to the bypaths, as it were, while the goose keeps to a few great open highways; its range is wider, its food supply is probably more various, and hence it has greater adaptiveness and variabil-

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ity. The swan is still more restricted in its range and numbers than the goose, and, in our hemisphere, is snow-white. The factor of protective coloration, so pronounced in the case of the goose, is quite ignored in the swan. Neither the goose nor the swan, so far as I know, has any winged enemies, but their eggs and young are doubtless in danger at times from foxes and wolves and water animals. The duck must have more enemies, because it is smaller, and is found in more diverse and sundry places. Upon the principle that like begets like, that variety breeds variety, one would expect the ducks to be more brightly and variously colored than their larger congeners, the geese and the swans.

The favorite notion of some writers on natural history, that it is a protective device when animals are rendered less conspicuous by being light beneath and dark above, seems to me a hasty conclusion. This gradation in shading is an inevitable result of certain fixed principles. It applies to inanimate objects also. The apples on the tree and the melons in the garden are protectively shaded in the same way; they are all lighter beneath and deeper-colored above. The mushrooms on the stumps and trees are brown above and white beneath. Where the light is feeblest the color is lightest, and *vice versa*. The under side of a bird's wing is, as a rule, lighter than the top side. The

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stronger the light, the more the pigments are developed. All fish that I am acquainted with are light beneath and dark above. If this condition helps to conceal them from their enemies, it is merely incidental, and not the result of laws working to that end.

III

“The danger of the mother bird during incubation” is a phrase often used by Darwin and by more recent writers. This danger is the chief reason assigned for the more obscure coloring of the female among so many species. Now it would seem that the dangers of the mother bird during incubation ought to be far less than those of her more brilliantly colored mate, flitting from tree to tree and advertising his whereabouts by his calls and song, or absorbed in procuring his food; or than those of other females, flying about exposed to the eye of every passing hawk. The life of most wild creatures is like that of a people engaged in war: enemies lurk on every hand, and the danger to the sitting bird may be compared in degree to that of the wife rocking the cradle by her fireside; while her roving mate must face perils equal to those of a soldier on a campaign. The mother bird is generally well hidden, and has nothing to do but to use her eyes and ears, and she usually does this to good purpose. Indeed, I believe the sitting bird is rarely destroyed. I have never known it to happen, though this fact

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does not prove very much. The peril is to the eggs or to the unfledged young; these cannot run or fly away. Eliminate this danger — this and the danger from storms and cold — and the numbers of our birds would probably double in a single year. Hence the care the birds take to conceal their nests, not for the mother bird's sake, but for the sake of the treasures which she cannot defend. In some cases she appears to offer herself an easy victim in order to lure the intruder away. She would have him see only herself when she flutters, apparently disabled, over the ground. The game of concealment has failed; now she will try what feigning can do.

All the species of our birds in which the male is more brilliantly colored than the female, such as the scarlet tanager, the indigo-bird, the rose-breasted grosbeak, the goldfinch, the summer tanager, the Virginia cardinal, the blue grosbeak, build in trees or low bushes, and it seems to me that the dull tints of the female would play but little part in concealing the nest. The enemies of these birds — as of most of our birds — are crows, squirrels, black snakes, jays, weasels, owls, and hawks, and have been for untold generations. Now the obscure coloring of the female would play no part in protecting her against any of these creatures. What would attract their attention would be the nest itself. The crows, the jays, the weasels, the squirrels, explore the trees looking for eggs and

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young birds, as doubtless the owls do by night. The mother bird flies at their approach, and leaves her eggs or young to be devoured. The sitting bird usually is not visible to an enemy passing in the air above, as she is hidden by the leaves. In the care of the young the male is as active and as much exposed to danger as is the female, and in the case of the scarlet tanager the male seems the bolder and the more active of the two; yet the female, because of her obscure coloring, could afford to run many more chances than he.

With the ground-builders the case is not much different. These birds are preyed upon by prowlers, — skunks, weasels, rats, snakes, crows, minks, foxes, and cats, — enemies that hunt at close range by night and by day, and that search the ground by sight and by smell. It is not the parent bird, but the eggs and the young, that they capture. Indeed, I cannot see that the color of the sitting bird enters into the problem at all. Red or white or blue would not endanger the nest any more than would the neutral grays and browns. The bobolink builds in meadows where the grass alone conceals it. That the back of the sitting bird harmonizes perfectly with the meadow bottom might make a difference to the egg-collector, or to an eye a few feet above, but not to the mink, or the skunk, or the snake, or the fox, that came nosing about the very spot.

Last summer I saw where a woodcock had made

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her nest in a dry, grassy field many yards from a swamp in the woods, which was her natural habitat. The instinct of the bird seemed to tell her that she would be less exposed to her prowling enemies in the dry, open field than in the thick, swampy woods, and her instinct was, no doubt, a safe guide. Her imitative color would avail her but little in either place. The same may be said of the quail and of the grouse. Their neutral tints may protect them from the human eye, but not from their natural enemies. Could the coon, or the mink, or the fox, or the skunk be baffled by them? Is the setter or pointer baffled? Both the quail and the partridge, in settled countries, are very likely to nest along roads and paths, away from thick jungles and tangles that would afford cover to their enemies. It is their eggs and their newly hatched young that they are solicitous about. Their wings afford security to themselves. True, the sitting bird usually allows the passer-by to approach her very closely, but I have reason to believe that she is much sooner alarmed by an animal that approaches stealthily, nosing about, making very little noise, than by the passing of a person or of the large grazing animals. Her old traditional enemies are stealthy and subtle, and her instinct keeps her on her guard against them. A person walking boldly along, occupied about his own business, can pass within a few feet of a partridge on his drumming log. But let a man try

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to creep up on the drumming partridge, and the bird will instantly show how wary and suspicious he is.

The female cowbird is much duller in color than the male, and yet she is a parasitical bird, and does no incubating at all. With the rose-breasted grosbeak, the male seems to do his share of the incubating, and has been heard to sing upon the nest.

A fact that seems to tell against the notions I have been advancing, and that gives support to the theory of the protective value of dull colors, is the fact that with those species of birds in which both sexes are brightly colored, the nest is usually placed in a hole, or is domed, thus concealing the sitting bird. This is true of a large number of species, as the bluebird, the woodpeckers, the chickadee, the nuthatch, the kingfisher, and, in the tropics, the various species of parrots and parrakeets and many others, all birds of brilliant plumage, the sexes being in each case indistinguishable. But there are such marked exceptions to this rule that, it seems to me, its force is greatly weakened. Our blue jay is a highly colored bird, and yet it builds an open nest. The crow builds an open nest. The passenger pigeon was a bird of rather showy colors, and the male did his share of the incubating, still the nest was built openly. The shrike is a conspicuously marked bird, and it builds an open nest. Mr. Wallace names four other brilliant Old-World birds that build open nests. Then there are several

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species of birds, in which the female is obscurely marked, that build in holes and cavities, such as our wrens, the great crested flycatcher, the European starling, the English sparrow, the bush-tits of California, and the wood duck. The female oriole is much duller-colored than her mate, yet she builds a pocket nest. Of course these last cases do not prove that there is not greater safety in a hidden nest, they only show that the color of the mother bird is not the main factor in the problem. But that a bird in a hole is safer than a bird in an open nest may well be doubted. The eggs are probably more secure from the thievish crow and the blue jay, but not from rats and squirrels and weasels. I know that the nests of the bluebird and the chickadee are often broken up by some small enemy.

We fancy that the birds are guided by their instinct for protective colors in the materials they choose for their nests. Most birds certainly aim to conceal their nests — the solitary builders, but not those that nest in communities, like the cliff swallows and rooks and flamingoes — and the materials they use favor this concealment. But what other materials could they use? They choose the material everywhere near at hand, — moss, leaves, dry grass, twigs, mud, and the like. The ground-builders scrape together a few dry straws and spears of grass; the tree-builders, twigs and lichens and cotton and rootlets and other dry wood

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products. There is nothing else for them to use. If a man builds a hut or a shanty in the fields or woods with such material as he finds ready at hand, his habitation will be protectively colored also. The winter wren builds its mouse-like nest of green moss, but in every case that has come under my observation the nest has been absolutely hidden by its position under a log or in a stump, or amid the roots of trees, and the most conspicuous colors would not have betrayed it to its enemies. In fact, the birds that build hidden nests in holes or tree cavities use of necessity the same neutral materials as those that build openly.

Birds that deliberately face the exterior of their nests with lichens obtained from rocks and trees, such as the hummingbird, the blue-gray gnat-catcher, and the wood pewee, can hardly do so with a view to protection, because the material of their nests is already weather-worn and inconspicuous. The lichens certainly give the nest an artistic finish and make it a part of the branch upon which it is placed, to an extent that suggests something like taste in the builders. But I fail to see how a marauding crow, or a jay, or a squirrel, or a weasel, or any other enemy of the bird could be cheated by this device.

IV

I find myself less inclined to look upon the neutral grays and browns of the animal world as the result

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of the struggle for existence, but more disposed to regard them as the result of the same law or tendency that makes nature in general adaptive and harmonious — the outcome of the blendings, the adjustments, the unifying processes or tendencies that are seen and felt all about us. Is not open-air nature ever striving toward a deeper harmony and unity? Do not differences, discrepancies, antagonisms, tend to disappear? Is there not everywhere something at work to bring about agreements, correspondences, adaptations? to tone down contrasts, to soften outlines, to modify the abrupt, to make peace between opposites? Is not the very condition of life and well-being involved in this principle? The abrupt, the disjointed, the irreconcilable, mean strife and dissolution; while agreements, gradations, easy transitions, mean life and growth. Like tends to beget like; the hand is subdued to the element it works in. The environment sets its stamp more or less strongly upon all living things. Even the pyramids are the color of the sands. Leave your bones there, and they will soon be of the same tint. Even your old boots or old coat will in time come to blend a little with the desert.

The tendency in nature that is over all and under all is the tendency or effort toward harmony — to get rid of strife, discord, violent contrasts, and to adjust every creature to its environment. Inside of this great law or tendency are the lesser

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laws of change, variety, opposition, contrast. Life must go on, and life for the moment breaks the unity, the balance. May not what is called protective coloration be largely this stamp of the environment, this tendency to oneness, to harmony and simplicity, that pervades nature, organic no less than inorganic?

Things in nature blend and harmonize; one thing matches with another. All open-air objects tend to take on the same color-tones; everything in the woods becomes woodsy, things upon the shore get the imprint of the shore, things in the water assume the hues of the water, the lichen matches the rock and the trees, the shell matches the beach and the waves; everywhere is the tendency to unity and simplicity, to low tones and adaptive colors.

One would not expect animals of the plains or of the desert to be colored like those of the bush or of the woods; the effects of the strong uniform light in the one case and of the broken and checkered light in the other would surely result in different coloration. That never-ending brown or gray or white should not in time stamp itself upon the creatures living in the midst of them is incredible.

Through the action of this principle, water animals will be water-colored, the fish in tropic seas will be more brilliantly colored than those in northern seas, tropical birds and insects will be of gayer

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hues than those of the temperate zones, shore birds will be shore-tinted, Arctic life will blend more or less with Arctic snows, ground animals will assimilate to the ground colors, tree animals will show greater variety in tint and form, plains animals will be dull of hue like the plains — all this, as I fancy, not primarily for protection or concealment, but through the law of natural assimilation, like begetting like, variety breeding variety.

What more natural than that strictly wood birds should be of many colors and shades, to be in keeping with their surroundings? Will not the play of light and shade, the multiplicity of forms, and the ever moving leaves come in time to have their due effect? Will not a variety of influences tend to produce a variety of results? Will not sameness breed sameness? Would not one expect the hummingbirds to be more brilliant than the warblers, and the warblers more varied in color than the finches? the insect-feeders than the seed-eaters? The hummingbirds are, as it were, begotten by the flowers and the sunshine, as the albatross is begotten by the sea, and the whippoorwill by the dusk. The rat will not be as bright of tint as the squirrel, nor the rabbit as the fox.

In the spring one may sometimes see a bluebird, or a redbird, or a bright warbler for a moment upon the ground. How artificial and accidental it looks, like a piece of ribbon or a bit of millinery dropped

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there! It is not one with the ground, it is not at home there. In the tree it is more in keeping with the changing forms and the sharper contrasts.

The environment is potent in many ways. Everything is modified by the company it keeps. Do not the quiet tints and sounds of the country have their effect upon the health and character of the dwellers there? The citizen differs in look and manner from the countryman, the lawyer from the preacher and the doctor, the seaman from the landsman, the hermit from the cosmopolite. There is the rural dullness, and there is the metropolitan alertness. Local color, local quality, are realities. States, cities, neighborhoods, have shades of difference in speech and manner. The less traveled a people are, the more marked these differences appear. The more a man stays at home, the more the stamp of his environment is upon him. The more limited the range of an animal, the more it is modified by its immediate surroundings. Thus the loon is so much of a water bird that upon the land it can only hobble, and the swallow is so much a creature of the air that its feet are of little use to it. Perfect adaptability usually narrows the range, as the skater is at home only upon the ice.

Here are two closely related birds of ours, the oven-bird and the water-thrush, both with speckled breasts, but each tinted more or less like the ground it walks upon, the one like the dry leaves, the other

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like the brook stones and pond margins. The law of assimilation and of local color has done its perfect work. Were the two birds to change places, each retaining its own color, I do not believe they would be in any more jeopardy than they are now.

The camel is of a uniform gray like the desert where it is at home, while the camelopard, or giraffe, a creature of the trees, is dappled or spotted. Is the color in either case protective? Against what? Their size and movements would disclose them to their natural enemies wherever they were.

The lion is desert-colored too. Is this for concealment from its prey? But it is said that horses and oxen scent the lion long before they can see him, as doubtless do the wild desert creatures upon which he feeds. Their scent would surely be keener than that of our domesticated animals, and to capture them he must run them down or ambush them where the wind favors him. His desert color is the brand of his environment. If his home were the rocks or the mountains, his color would certainly be different. Nothing could be duller or more neutral than the color of the elephant, and surely he is not hiding from any natural enemy, or stalking any game.

The bright colors of many tropical fish, such as the angel-fish, seem only a reflection of the bright element in which they live. The changing brilliant

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hues of tropic seas are expressed in the animal life in them. It is highly improbable that this is for protection; it is the law of assimilation working in the deep. All life in the tropics is marked by greater eccentricity of form and richness of coloring than in the temperate zones, and this is in keeping with the above principle.

V

It seems to me that the question that enters most deeply into the life problem of an animal is the question of food and climate, and of climate only so far as it affects the food supply. Many of our migrating birds will brave our northern winters if they can get anything to eat. A few years ago our bluebirds in the eastern part of the continent were fearfully decimated by a cold wave and an ice storm in the South that cut off their food supply. For two or three years rarely was a bluebird seen in those parts of the country where, before that event, they had been abundant. Then they began to reappear, and now, it seems to me, there are more bluebirds than ever before. Evidently their bright colors have not stood in the way of their increase. If they have now reached their limit, it is because they have reached the limit of their food supply and their nesting-sites.

How abundant are the robins everywhere, how noisy, how conspicuous! I do not doubt in the least

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that if, retaining the same habits, they were scarlet, or white, or indigo, they would be just as numerous as they are now. The robin is a wide, free feeder, boring in the turf for grubs and worms in summer, and taking up with cedar berries and hardhack drupes in winter. If a crop of locusts come in cherry time, he will spare your cherries. If a drouth drives the angleworms deep into the ground in August, look out for your grapes. The robin is wonderfully adaptive. If he does not find a tree to his liking, he will nest on the wall, or under your porch, or even on the ground. His colors are not brilliant, but the secret of his success lies in his courage, his force of character, so to speak, and his adaptability. His European cousin, the blackbird, is less protectively colored, but is of similar habits and disposition, and seems to thrive equally well. Again, contrast the Baltimore oriole with the orchard oriole. If there is anything in protective color, the more soberly colored bird has greatly the advantage, and yet the more brilliant species is far more abundant. The strong contrast of black and orange which the brilliant coats present does not seem to have lessened their wearers' chances of survival. Their pendent nests, beyond the reach of weasels and squirrels and snakes and crows, are no doubt greatly in their favor, but still more so, I believe, are their feeding habits. Compared with the orchard oriole, they are miscellaneous feeders; insects and

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fruit and even green peas are in their bill of fare. When a bird like the orchard oriole is restricted in its range, it is quite certain that its food supply is equally restricted.

Of birds that live upon tree-trunks, here are two of similar habits, one protectively colored and the other not, and yet the one that is of bright tints is far the more numerous. I refer to the nuthatch and the brown creeper. The creeper is so near the color of the bark of the trees upon which it feeds that one has great difficulty in seeing it, while the nuthatch in its uniform of black, white, and blue, contrasts strongly with its surroundings. The creeper works up and around the tree, rarely showing anything but its bark-colored back, while the nuthatch hops up and down and around the tree with head lifted, constantly exposing its white throat and breast. But the nuthatch is the better feeder, it eats nuts as well as the larvæ of insects, while the creeper seems limited to a minute kind of food which it obtains with that slender, curved bill. It can probe, but not break, with this instrument, and is never seen feeding upon the ground, like the nuthatch. I am bound to state, however, that the latter bird has another advantage over the demure creeper, which may offset the danger that might come to it from its brighter color—it is more supple and alert. Its contact with the tree is like that of the rocker with the floor, while the line of the creeper's

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back is more like that of the rocker reversed; it touches head and tail, and has far less freedom of movement than has the nuthatch. The head of the latter often points straight out from the tree, and the eye takes in all the surroundings to an extent that the creeper's cannot.

Of course it is not safe to claim that one can always put his finger upon the exact thing that makes one species of birds more numerous than an allied species; the conditions of all animal life are complex, and involve many factors more or less obscure. In the present case I am only trying to point out how slight a part color seems to play in the problem, and how prominent a part food plays. Our ruffed grouse holds its own against the gunners, the trappers, the hard winters, and all its numerous natural enemies, not, I think, because it is protectively colored, but because it, too, is a miscellaneous feeder, ranging from berries and insects to buds and leaves. The quail has the same adaptive coloring, but not the same range of food supply, and hence is more easily cut off. Birds that subsist upon a great variety of foods, no matter what their coloring, apparently have the best chance of surviving.

VI

There seem to be two instincts in animal life that work against the influence of environment upon the colors of animals, or the tendency in Nature to

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make her neutral grays and browns everywhere prevail — the male instinct of reproduction, which is major, and the social or gregarious instinct, which is minor, but which, I am inclined to believe, has its effect.

The gregarious birds and mammals are as a rule less locally colored than those of solitary habits. Thus the more gregarious elk and antelope and sheep are less adaptively colored than the more solitary deer. The buffalo had not the usual color of a plains animal; the individual was lost in the mass, and the mass darkened the earth. The musk ox goes in herds and does not put on a white coat in the sub-Arctic regions.

Does a solitary life tend to beget neutral and obscure tints in a bird or beast? The flocking birds nearly all tend to bright colors, at least brighter than their solitary congeners. The passenger pigeon furnished a good example near at hand. Contrast its bright hues with those of the more recluse turtle-dove. Most of our blackbirds have a strong flocking instinct, and they are conspicuously colored. The sociability of the cedar-birds may help to account for their crests, their banded tails, and their pure, fine browns. As soon as any of the ground birds show a development of the flocking instinct, their hues become more noticeable, as is the case with the junco, the snow bunting, the shore lark, and the lark bunting of the West. Among the tree *Fringil-*

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lida the same tendency may be noticed, the flocking crossbills, pine grosbeaks, redpolls, and the like, all being brighter of color than the solitary sparrows. The robin is the most social of our thrushes, and is the brightest-colored.

In the tropics the parrots and parrakeets and macaws are all strikingly colored, and are all very social. Why should not this be so? Numbers beget warmth and enthusiasm. A multitude is gay of spirit. It is always more noisy and hilarious, more festive and playful, than are single individuals. Each member is less a part of its surroundings and more a part of the flock or the herd. Its associations with nature are less intimate than with its own kind. Sociability, in the human species, tends to express itself in outward symbols and decorations, and why may not the brighter colors of the social birds be the outward expression of the same spirit?

The social flamingo does not, in the matter of color, seem to have been influenced by its environment at all. The gregarious instinct is evidently very strong in the species. Mr. Frank M. Chapman found them in the Bahamas living and breeding in great colonies; he discovered what he calls a flamingo city. The birds all moved and acted in concert. Their numbers showed in the distance like an army of redcoats; they made the land pink. They were adapted to their marsh life by their long legs, and to the food they ate by their bills, but their

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colors contrasted strongly with their surroundings. The community spirit carried things with a high hand. The same is in a measure true of the ibis, the stork, the crane — all birds more or less gregarious, and all birds of more or less gay plumes. But our solitary great blue heron, lone watcher in marshes and by pond and river margins, is obscurely colored, as is the equally solitary little green heron.

Our blue heron will stand for hours at a time on the margin of some lake or pond, or on the top of some forest tree near the water, and the eye might easily mistake him for some inanimate object. He has watched among roots and snags and dead tree-tops so long that he has naturally come to look like these things. What his enemies are, that he should need to hide from them, other than the fool with the gun, I do not know.

Among gregarious mammals the same spirit seems at work to check or modify the influence of the environment.

The common crow illustrates this spirit in a wider field. The crow is a citizen of the world; he is at home everywhere, but in the matter of color he is at home nowhere. His jet black gives him away at all times and in all places. His great cunning and suspicion — whence do they come? From his experiences with man?

I do not know that there is very much in this

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idea as to the effect of the social instinct upon the colors of animals. I only throw it out as a suggestion.

When we come to the reproductive principle or instinct, then do we strike a dominating influence; then is there contrast and excess and riot; then are there positive colors and showy ornaments; then are there bright flowers, red, orange, white, blue; then are there gaudy plumes of birds, and obtrusive forms and appendages in mammals. The old modesty and moderation of nature are abandoned. It is not now a question of harmony and quietude, but of continuing the species. Masses of color appear in the landscape; silent animals become noisy; birds burst into song, or strut and dance and pose before one another; the marshes are vocal; hawks scream and soar; a kind of madness seizes all forms of life; the quail whistles; the grouse drums in the woods, or booms upon the prairie; the shellfish in the sea, and the dull turtle upon the land, feel the new impulse that thrills through nature. The carnival of the propagating instinct is at hand. For this, and begotten by this, are the gaudy colors and the beautiful and the grotesque ornaments.

As a rule, the females are not implicated in this movement or craze to the extent that the males are. Even among the flowering plants and trees in which the two sexes are separated, the male is showy while the female is inconspicuous. The pollen-yield-

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ing catkins of the hazel and of the hickory and oak flaunt in the wind, seen by all passers, while the minute fruit-producing flower is seen by none. Nature always keeps nearer to her low tones, to her neutral ground, in the female than in the male; the female is nearer the neuter gender than is the male. She is negative when he is positive; she is more like the quiet color tones in nature; she represents the great home-staying, conservative, brooding mother principle that pervades the universe. Harmony, repose, flowing lines, subdued colors, are less the gift of the aggressive, warring masculine element than of the withdrawing and gentle feminine element. That the earth is our mother, the sun our father, is a feeling as old as the human race, and throughout the animal world the neutral and negative character of the one and the color and excess of the other still mark the two sexes. Why, in the human species, the woman runs more to the ornate and the superfluous than does the man is a question which no doubt involves sociological considerations that are foreign to my subject.

Darwin accounts for the wide departure from the principle of utility and of protective coloration in the forms and colors of so many birds and mammals upon his theory of sexual selection, or the preference of the female for bright colors and odd forms. Wallace rejects this theory, and attributes these things to the more robust health and vigor of the

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males. However, in the matter of health the females of all species seem on a par with the males, though in many cases the males are the larger and the more powerful. But among our familiar birds, when the two sexes differ in color, the brighter-plumaged male, with rare exceptions, is no larger or more vigorous than the female.

The principle to which I have referred seems to me adequate to account for these gay plumes and fantastic forms — the male sexual principle, the positive, aggressive instinct of reproduction, always so much more active in the male than in the female; an instinct or passion that banishes fear, prudence, cunning, that makes the timid bold, the sluggish active, that runs to all sorts of excesses, that sharpens the senses, that quickens the pulse, that holds in abeyance hunger and even the instinct of self-preservation, that arms for battle and sounds forth the call, and sows contention and strife everywhere; the principle that gives the beard to the man, the mane to the lion, the antlers to the stag, the tusks to the elephant, and — why not? — the gorgeous plumes and bright colors to the male birds of so many species. The one thing that Nature seems to have most at heart is reproduction; she will sacrifice almost everything else to this — the species must be perpetuated at all hazards, and she has, as a rule, laid the emphasis in this matter upon the male. The male in the human species is positive,

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or plus, while the female is negative. The life of the female among the lower animals runs more smoothly and evenly — is more on the order of the neutral tint — than is that of the male. The females of the same group differ from one another much less than do the males. The male carries a commission that makes him more restless, feverish, and pugnacious. He is literally “spoiling for a fight” most of the time. This surplusage, these loaded dice, make the game pretty sure.

Cut off the ugly bull’s horns, and you have tamed him. Castration tames him still more, and changes his whole growth and development, making him approximate in form and disposition to the female. I fancy that the same treatment would have the same effect upon the peacock, or the bird of paradise, or any other bird of fantastic plumage and high color. Destroy the power of reproduction, and the whole masculine fabric of pride — prowess, weapons and badges, gay plumes and decorations — falls into ruins.

When we remember how inattentive and indifferent the females of all species of birds are to the displays of the males before them, it is incredible that their taste in fashions, their preferences for the gay and the ornate, should have played any considerable part in superinducing these things.

Darwin traces with great skill the gradual development of the ball and socket ocelli in the plumage

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of the Argus pheasant. It was evidently a long, slow process. Is it credible that the female observed and appreciated each successive slight change in the growth of these spots, selecting those males in which the changes were most marked, and rejecting the others? How could she be so influenced by changes so slight and so gradual that only a trained eye would be likely to take note of them? It is imputing to the female bird a degree of taste and a power of discrimination that are found only in mankind. Why, then, it may be asked, is the male so active in showing off his finery before the female? Of course it is to move her, to excite her to the point of mating with him. His gay plumes are the badge of his masculinity, and it is to his masculinity that her feminine nature responds. She is aroused when he brings to bear upon her all the batteries of his male sex. She is negative at the start, as he is positive. She must be warmed up, and it is his function to do it. She does not select; she accepts, or rejects. The male does the selecting. He offers himself, and she refuses or agrees, but the initiative is with him always. He would doubtless strut just the same were there no hens about. He struts because he has to, because strutting is the outward expression of his feelings. The presence of the hen no doubt aggravates the feeling, and her response is a reaction to the stimuli he offers, just as his own struttings are reactions to the internal stimuli that are at the

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time governing him. In the Zoo at the Bronx the peacock has been seen to strut before a crow.

Undoubtedly the males in whom the masculine principle is the strongest and most masterful are most acceptable to the females, and the marvelous development of form and color in the peacock, or in the Argus pheasant, might take place under the stimulus of continued success. If there are two rival cocks in the yard, the hens will, as a rule, prefer the victor — the one that struts the most and crows the loudest. How amusing to see the defeated cock fold his wings, depress his plumage, and look as unpretentious and henlike as possible in the presence of his master!

If the male bird sang only while courting the female, we might think he sang only to excite her admiration, but he continues to sing until the young appear, and, fitfully, long after that, his bright colors in many cases gradually disappearing with his declining song impulse, and both fading out as the sexual instinct has run its course. It was the sexual impulse that called them into being, and they decline as it declines. It is this impulse that makes all male birds so pugnacious during the breeding season. Not only does a brighter iris come upon the burnished dove in the spring, but also a warmer glow comes upon the robin's breast, and the hues of all other male birds are more or less deepened and intensified at this time. Among many kinds of

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fish the males put on brighter colors in the spring, and surely this cannot be to win the females, as there is no proper mating among them.

The odd forms and bizarre colors that so often prevail among birds, more especially tropical and semi-tropical birds, and among insects, suggest fashions among men, capricious, fantastic, gaudy, often grotesque, and having no direct reference to the needs of the creatures possessing them. They are clearly the riot and overflow of the male sexual principle — the carnival of the nuptial and breeding impulse. The cock or sham nests of the male wrens seem to be the result of the excess and overflow of the same principle.

It is not, therefore, in my view of the case, female selection that gives the males their bright plumage, but the inborn tendency of the masculine principle to riot and overplus. There is, strictly speaking, no wooing, no courtship, among the four-footed beasts, and yet the badges of masculinity, manes, horns, tusks, pride, pugnacity, are as pronounced here as are the male adornments among the fowls of the air.

Why, among the polygamous species of birds, are the males so much more strongly marked than among the monogamous? Why, but as a result of the superabundance and riot of the male sexual principle? In some cases among the quadrupeds it even greatly increases the size of the males over the females, as among the polygamous fur seals.

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Darwin came very near to the key of the problem that engaged him, when he said that the reason why the male has been the more modified in those cases where the sexes differ in external appearance is that "the males of almost all animals have stronger passions than the females."

"In mankind, and even as low down in the scale as in the *Lepidoptera*, the temperature of the body is higher in the male than in the female." (Darwin.)

If the female refuses the male, it is not because he does not fill her eye or arouse her admiration, but because the mating instinct is not yet ripe. Among nearly all our birds the males fairly thrust themselves upon the females, and carry them by storm. This may be seen almost any spring day in the squabbles of the English sparrows along the street. The female appears to resist all her suitors, defending herself against them by thrusting spitefully right and left, and just what decides her finally to mate with any one of them is a puzzle. It may be stated as a general rule that all females are reluctant or negative, and all males are eager or positive, and that the male wins, not through the taste of the female, — her love for bright colors and ornamental appendages, — but through the dominance of his own masculinity. He is the stronger force, he is aggressive and persuasive, and finally kindles her with his own breeding instinct.

Even among creatures so low in the scale of life

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as the crab, the males of certain species, during the breeding season, dance and gyrate about the females, assuming many grotesque postures and behaving as if intoxicated — as, indeed, they are, with the breeding passion.

Evidently the female crab does not prefer one male over another, but mates with the one that offers himself, as soon as he has excited her to the mating point. And I have no proof that among the birds the female ever shows preference for one male over another; she must be won, of course, and she is won when the male has sufficiently aroused her; she does not choose a mate, but accepts one at the right time. I have seen two male bluebirds fight for hours over a female, while she sat and looked on indifferently. And I have seen two females fight over a male, while he sat and looked on with equal indifference. "Either will suit, but I want but one."

Of course Nature does not work as man works. Our notions of prudence, of precision, of rule and measure, are foreign to her ways. The stakes are hers, whoever wins. She works by no inflexible system or plan, she is spontaneous and variable every moment. She heaps the measure, or she scants the measure, and it is all one to her. Our easy explanations of her ways — how often they leave us where they found us! The balance of life upon the globe is fairly well maintained by checks and

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counter-checks, by some species being prolific and other species less so, by the development of assimilative colors by one kind, and of showy colors by another, by slow but ceaseless modifications and adaptations. It is a problem of many and complex factors, in which, no doubt, color plays its part, but I believe this part is a minor one.

NOTE.—Since writing the above essay I have read Geddes and Thomson on "The Evolution of Sex," and find that these investigators have anticipated my main idea in regard to the high coloration and ornamentation of male birds, namely that these things inhere in the male principle, or are "natural to maleness." The males put on more beauty than females "because they are males, and not primarily for any other reason whatever." "Bright coloring or rich pigmentation is more characteristic of the male than of the female constitution." "Males are stronger, handsomer, or more emotional simply because they are males, — *i. e.*, of more active physiological habit than their mates." The males tend to live at a loss, and are relatively more *katabolic*; the females, on the other hand, tend to live at a profit, and are relatively more *anabolic*.

"Brilliancy of color, exuberance of hair and feathers, activity of scent-glands, and even the development of weapons, cannot be satisfactorily explained by sexual selection alone, for this is merely a secondary factor. In origin and continued development they are outcrops of a male as opposed to a female constitution."

VI

STRAIGHT SEEING AND STRAIGHT THINKING

I

A NEWSPAPER correspondent the other day asked me what I meant by truth in natural history. "We know that no two persons see alike," he said, "or see the same things; behold the disagreements in the testimony of eye-witnesses to the same occurrences." "True," I replied; "but when two persons shoot at a mark, they must see alike if they are both to hit the mark, and two witnesses to a murder or a robbery must agree substantially in their testimony if they expect to be credited in the court-room." In like manner, two observers in the field of natural history must in the main agree in their statements of fact if their observations are to have any scientific value. Notwithstanding it is true that we do not all see the same things when we go to the fields and woods, there is such a thing as accurate seeing, and there is such a thing as inaccurate seeing and reporting.

By truth in natural history I can mean only that which is verifiable; that which others may see under like conditions, or which accords with the observa-

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tions of others. You may not see just what I do in the lives of the birds or the quadrupeds, but you will see that which belongs to the same order of facts, just as you will in the world of physics. You will not see iron floating and wood sinking under like conditions, or trees growing with their roots in the air. You may see to-day something in the life of a bird, or a bee, or a beast, that neither I nor any one else ever saw before, but it will belong to the same order of things that I and others have seen these creatures do. You will not see a woodchuck hanging to a limb by his tail like a possum, nor a fox sleeping in the top of a tree like a coon, nor a loon running a race between lines of interested spectators, nor crows hoarding trinkets in a hollow stump, nor the old teaching their young this or that, and so on. No, you may send a thousand good observers to the woods every day for a thousand years, and not one of them will see any of the novel and surprising, not to say impossible, things of which the "nature fakers" see so many every time they take a walk. The nature faker's fantastic natural history is not verifiable. I have seen blackbirds build their nests in the side of an osprey's nest, and all seemed to go well — the osprey is exclusively a fish-eater — but if any person were to tell me that he had seen them build their nests alongside of that of the eagle or the hen-hawk, or that he had seen bluebirds breeding in a cavity with

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the hoot owl, I should know him as a faker. The rabbit is not on visiting terms with the fox or the mink, nor do the robins welcome a call from the jays.

I did something the other day with a wild animal that I had never done before or seen done, though I had heard of it: I carried a live skunk by the tail, and there was "nothing doing," as the boys say. I did not have to bury my clothes. I knew from observation that the skunk could not use its battery with effect without throwing its tail over its back; therefore, for once at least, I had the courage of my convictions and verified the fact.

A great many intelligent persons tolerate or encourage our fake natural history on the ground that they find it entertaining, and that it interests the school-children in the wild life about them. Is the truth, then, without value for its own sake? What would these good people think of a United States school history that took the same liberties with facts that certain of our nature writers do: that, for instance, made Washington take his army over the Delaware in balloons, or in sleighs on the solid ice with bands playing; or that made Lincoln a victim of the Evil Eye; or that portrayed his slayer as a self-sacrificing hero; or that represented the little Monitor that eventful day on Hampton Roads as diving under the Merrimac and tossing it ashore on its beak?

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The nature fakers take just this kind of liberties with the facts of our natural history. The young reader finds it entertaining, no doubt, but is this sufficient justification?

Again, I am told that the extravagant stories of our wild life are or may be true from the writer's point of view. One of our publishing houses once took me to task for criticising the statements of one of its authors by charging that I had not considered his point of view. The fact is, I had considered it too well; his point of view was that of the man who tells what is not so. As if there could be more than one legitimate point of view in natural history observation — the point of view of fact!

There is a great deal of loose thinking upon this subject in the public mind.

An editorial writer in a New England newspaper, defending this school of writers, says:—

“Their point of view is that of the great out-of-doors, and comes from loving sympathy with the life they study, and is as different from that of the sportsman and the laboratory zoölogist as a notebook differs from a rifle or a microscope.”

Now how the point of view of the “great out-of-doors” can differ from the point of view of the little indoors in regard to matters of fact is hard to see. A man who watches the ways of an animal in the wilderness, or from the mountain-top, is bound by the same laws of truthfulness as the man who sees

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it through his study window. What the writer means is doubtless that the spirit in which the literary naturalist — the man who goes to the fields and woods for material for literature — treats the facts of natural history differs from the spirit in which the man of pure science treats his. Undoubtedly, but the two alike deal with facts, though with facts of a different order.

The scientist, the artist, the nature-lover, and the like, all look for and find different things in nature, yet there is no contradiction between the different things they find. The truth of one is not the falsehood of another. The field naturalist is interested in the live animal, the laboratory zoölogist in the measuring and dissecting of the dead carcass. What interests one is of little or no interest to the other. So with the field botanist as compared with the mere herbalist. Both are seekers for the truth, but for a different kind of truth. One seeks that kind of truth that appeals to his emotion and to his imagination; the other that kind of truth — truth of structure, relation of parts, family ties — that appeals to his scientific faculties. Does this fact, therefore, give the nature faker warrant to exaggerate or to falsify the things he sees in the fields and woods? Let him make the most of what he sees, embellish it, amplify it, twirl it on the point of his pen like a juggler, but let him beware of adding to it; let him be sure he sees accurately. Let him beware

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of letting invention take the place of observation. It is one thing to work your gold or silver up into sparkling ornaments, and quite another to manufacture an imitation gold or silver, and this is what the nature fakers do. Their natural history is for the most part a sham, a counterfeit. No one quarrels with them because they are not scientific, or because they deal in something more than dry facts; the ground of quarrel is that they do not start with facts, that they grossly and absurdly misrepresent the wild lives they claim to portray.

A Wisconsin editor, writing upon this subject, shoots wide of the mark in the same way as does the New England editor. "Knowledge born of scientific curiosity," he says, "has nothing in common with the study of animal individuality which the 'nature fakers' have fostered and to which the public has proved responsive. There is all the difference in the world between being interested in the length of an animal's skull and being interested in the same animal's ways and personality." True enough, but this is quite beside the mark. The point at issue is a question of accurate seeing and reporting. The man who is reporting upon an animal's ways and personality is bound by the same obligations of truthfulness as the man who is occupied with the measurements of its skull. By all means let the literary naturalist give us traits instead of measurements. This he is bound to do, and the better

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he does it, the better we shall like him. We can get our statistics elsewhere. From him we want pictures, action, incident, and the portrait of the living animal. But we want it all truthfully done. The life history of any of our wild creatures, the daily and hourly course of its life, all its traits and peculiarities, all its adventures and ways of getting on in the world, are of keen interest to every nature student, but if these things are misrepresented, what then? There are readers, I believe, who say they don't care whether the thing is true or not; at any rate it is interesting, and that is enough. What can one say to such readers? Only that they should not complain if they are *stuck* with paste diamonds, or pinchbeck gold, or shoddy cloth, or counterfeit bills.

The truth of animal life is more interesting than any fiction about it. Can there be any doubt, for instance, that if one knew just how the fur seals find their way back from the vast wilderness of the Pacific Ocean, where there is, apparently, nothing for the eye, or the ear, or the nose to seize upon in guiding them, to the little island in Bering Sea that is their breeding haunt in spring — can there be any doubt, I say, that such knowledge would be vastly more interesting than anything our natural history romancers could invent about it? But it is the way of our romancers to draw upon their invention when their observation fails them. Thus

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one of them tells how the salmon get up the high falls that they meet with in the rivers they ascend in spring — it is by easy stages; they rest upon shelves or upon niches in the rocks behind the curtain of water, and leap from these upward through the pouring current till the top is gained; and he tells it as if he knew it to be a fact, when, in truth, it is a fiction.

Then this so-called individuality of the animals is enormously exaggerated by the nature fakers. The difference between two individuals of the same species in a wild state is but a small matter. What is true of one is practically true of all the others. They are all subject to the same conditions, and the life problems are essentially the same with each; hence their variations are but slight, while in the case of man the variations are enormous. One child is born a genius and another is born a dunce. The mass of mankind would still be sunk in barbarism had it not been for the few superior minds born in every age and country, who have lifted the standard of living and thinking to a higher plane. It is only when the lower animals are brought in contact with man and subjected to artificial conditions that wide diversity of character and disposition appears among them. Then we have on the farm the bucking horse, the intractable ox, the unruly cow, and, in the circus, the trained lion or tiger or elephant that suddenly "goes bad." In domestication the

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difference in the disposition of squirrels, foxes, coons, and other animals comes out, but in the wild state their habits and traits are practically all the same. A fox hunter who knows his territory well will point out to you the course all foxes when pursued by the hounds are very likely to take, generation after generation; the conformation of the land determining the course. Rarely does the fox run wild and upset the calculations of the hunter. But the differences between the behavior of hunted animals under like conditions is not, I think, an evidence of original traits and dispositions in the hunted. One grizzly, or one moose, or one wild boar will charge you when wounded, and another will run away. So will one stick of dynamite explode in the handling while others remain inert; so will one swarm of bees be ugly to-day and docile to-morrow. Slight differences in external conditions, no doubt, determine the result in each case.

I see the herring gulls flying up the river above the floating ice, as I write. Now all those gulls may not be absolutely alike to the last feather, but they are as nearly alike in character as the fragments of floating ice are alike in character. I would not dare affirm any trait or characteristic of one that I would not affirm of all the others. And the score or more of crows perched upon the ice beneath them — what one of those crows will do in its wild state, each and every other crow will or may do. There are no

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geniuses or heroes among them. Hence when our nature fakers claim that they study individuals and not species, they need watching. Let them exploit the individual certainly, but let them be cautious how they claim exceptional traits or intelligence for it.

Let me return to the editors. One of our most influential weekly journals, in defending the nature fakers against the attack of President Roosevelt, makes this statement: —

“We quite agree that fiction ought not to be palmed off on school-children as fact; but we do not agree with what is implied, that imagination may not be used in interpreting and narrating facts. Men see through their temperaments; the imaginative man sees through his imagination, and he is telling the truth if he tells what he sees as he sees it. Mr. Froude, who had a vivid historical imagination, was bitterly condemned by Mr. Freeman, who had none; but Mr. Froude’s history is not only interesting, while Mr. Freeman’s is dull, but very eminent authorities regard him as the better historian of the two.”

Behold what confusion of thought there is in this paragraph. The writer confounds the interpretation of facts with the observation of facts; he confounds the world of ideas with the world of concrete experiences; he confounds the historian of human annals with the eye-witness of daily events in

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the lives of our wild creatures. Neither Froude nor Freeman wrote from observation or experience, as our nature fakers claim to, but from the study of past men and events as recorded by others. They were interpreting the records, and their temperaments and imaginations greatly modified the results. But other things being equal, would we not prefer the historian who kept closest to the record, to the actual facts, of the case? Truthfulness is a merit, imagination is a merit, and neither can take the place of the other. When the two are combined, we get the best results.

Truth in natural history is much easier to reach than truth in civil history. Civil history is vastly more complex. Moreover, it is of the past in a sense that the other is not, and the writers of it are rarely the eye-witnesses of the events they describe; while natural history is being daily and hourly enacted all around us, and varies but little from year to year. A truthful account of the life history of one animal holds substantially correct for all the rest of that species in different places and times. The animal is a part of its environment, and has no independent history in the sense that a man has.

Certainly "the imagination may be used in interpreting and narrating facts" — must be used, if anything of literary value is to be the outcome. But it is one thing to treat your facts with imagination and quite another to imagine your facts. So long

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as the natural historian or the human historian is sound upon his facts, we know where we stand. But the faker is a faker because he disregards the facts. Froude uses more imagination in dealing with his material than Freeman did, hence he has much greater charm and power of style. It is only when he disregards the fact, or takes unwarranted liberties with it, that Freeman can justly criticise him.

There has been no such luminous interpreter of the facts of natural history as Darwin; he read their meaning as no one else had ever before done. His reason and his imagination went hand in hand. But was there ever a mind more loyal to the exact truth? Every man who brought him a fact brought him material for the edifice he was so intent upon building — an edifice which the human mind since his day is dwelling in with more and more contentment.

It is in the interpretation of natural facts and phenomena that temperament, imagination, emotional sensibility, come in play. In all subjective fields — in religion, politics, art; philosophy — one man's truth may be another man's falsehood, but in the actual concrete world of observation and experience, if we all see correctly, we shall all see alike. Blue is blue and red is red, and our color-blindness does not alter the fact. In emotional and imaginative fields a man may be "telling the truth if he tells what he sees as he sees it," but in the field

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of actual observation he is telling the truth only when he tells the thing as it really is, reports the habits and behavior of the animals as they really are. What do we mean by powers of observation but the power to see the thing as it is — to see the truth? An opulent imagination cannot make up for feeble powers of observation. The effect the fact observed has upon you, what you make of it, what it signifies to you — that is another matter. Here interpretation comes in, and on this line you have the field all to yourself. I may think your interpretation absurd, but I shall not question your veracity or honesty of purpose. We are very likely to differ in taste, in opinions about this and that, in religion, politics, art, but we must agree upon facts. Unless there is some chance that men can see and report accurately, what becomes of the value of human testimony as given by eye-witnesses on the witness stand? Things do fall out so and so, or they fall out otherwise; it is not a matter of imagination or of temperament in the beholder, but a matter of accurate seeing. In getting at the value of a man's testimony we may have to take into account his excitable or his phlegmatic temperament and the seductive power of his imagination, and eliminate them as so much dross in a metal. Eye-witnesses generally differ; we must reconcile the differences and sift out the facts.

The animal-story writers, such as Mr. Roberts

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and Mr. Seton, aim to give the charm of art and literature to their natural-history lore; so to work up their facts that they appeal to our emotion and imagination. This is legitimate and a high calling, provided they do not transgress the rule I have been laying down, which Mr. Roberts does when he represents the skunk as advertising his course through the woods to all other creatures by his characteristic odor, since the skunk emits that odor only when attacked, and is at all other times as odorless as a squirrel; or when he says the fox is too cunning to raid the poultry yard near its own door, but will go far off for its plunder. I wish the pair of foxes that had their den within easy rifle-shot of our farmhouse the past season had acted upon this policy. We should have reared more chickens, and one of the foxes would not have met his death in a charge of shot as he did while he was chasing a hen through the currant patch in broad daylight.

The principal aim of the teacher of nature study in the schools should be to help the children to see straight, to develop and sharpen their powers of observation, and to give them rational views of animal mentality.

When one of our nature writers, whose methods have been much criticised, says in the introduction to one of his books on animal life that he would "make nature study more vital and attractive by

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revealing a vast realm of nature outside the realm of science," is not one set to puzzling one's brain as to how there can be any legitimate nature study that will carry one beyond the realm of science? Is there any subject-matter in the books thus prefaced that science cannot deal with? And why does the author aver with such emphasis that his facts are all true and verifiable? — just the test that science demands. If it is all true and sound natural history, what puts it outside the realm of science? If it is not true and real, why call it nature study? Why not call it the gentle art of bearing false witness against the animals? But this realm of nature outside the realm of science — the realm of the occult — is not open to observation, and is therefore not a subject for nature study. The realm of science embraces the whole visible, tangible, and intangible universe. Is not that field enough for nature study? Can there be any other field? What lies outside of this is mere matter of speculation.

The works of the writer referred to are outside the realm of science only as every exaggeration and falsification is outside that realm, or as Alice in Wonderland and Jack and his beanstalk are outside. Such a course may make nature study more attractive to certain credulous minds, but it can hardly make it more vital, or add to our knowledge of the world and its denizens by which we are surrounded.

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II

To see accurately and completely is a power given to few; hence the observations of the majority of people are of no scientific value whatever. One spring I was interested in the question as to how the crow picks up a dead fish or other food from the surface of the water — with its feet or its bill. One would naturally say with its bill, of course, as all except the rapacious birds hold and carry things in their beaks. But one of our younger nature writers made the crow carry food for its young in its claws, and a teacher of zoölogy in a Western academy wrote that he had seen a crow pick up a dead fish from a pond and carry it ashore with its feet. I wrote and cross-questioned the teacher a little; among other things, I asked him if he had the point in question in mind when he saw the crow pick up the fish. As I never received an answer, I concluded that this witness broke down on the cross-examination.

I put the question to fishermen on the river: Had they ever seen a crow pick up anything from the surface of the water? Oh, yes, lots of times. Did he seize the object with his feet or his beak? They would pause and think, and then some would reply, "Indeed, I can't say; I did not notice." One man said emphatically, "With his feet;" another was quite as sure it was done with the bill.

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I myself was sure I had seen crows pick up food from the water, as gulls do, with the bill. I had the vision of that low stooping of the head while the bird was in the act. I asked my son, who spends much time on the river, and who is a keen observer. He had often seen the thing done, but was not certain whether it was with the beak or the feet. A few days later he was on the river, and saw a crow that had spied a fragment of a loaf of bread floating on the water. Having the point in mind, he watched the crow attentively. Down came old crow with extended legs, and my son said to himself, "Yes, he is going to seize it with his feet." But he did not; his legs went down into the water, for what purpose I cannot say, but he seized the bread with his beak, rose up with it and then dropped it, then seized it again in the same way and bore it toward a tree on the shore. Not many days later I saw a crow pick up something from the river in the same way: the feet went into the water, but the object was seized with the beak. The crow's feet are not talons, and are adapted only to perching and walking. So far as I know, all our birds, except birds of prey, carry their food and their nesting-material in their beaks.

One day I saw an eagle flying over with something like a rope dangling from its feet, probably a black snake. A bird carries its capture with the member by which it seizes it, which with birds of prey is the foot, and with other birds the beak. The

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kingfisher lives upon fish, and he always seizes them with his beak and swallows them head foremost.

Any testimony the value of which depends upon accuracy in seeing needs to be well sifted, so few persons see straight and see whole. They see a part, and then guess or fancy the rest. I have read that the Scotch fishermen will tell you that the loon carries its egg under its wing till it hatches. One would say they are in a position to know; their occupations bring them often into the haunts of the loon; yet the notion is entirely erroneous. The loon builds a nest and incubates its eggs upon the ground as surely as does the goose or duck.

Not till the mind is purged of dread, superstition, and all notions of a partnership between the visible and the occult will the eye see straight. The mind that is athirst for the marvelous and the mysterious will rarely see straight. The mind that believes the wild creatures are half human, that they plot and plan and reason as men do, will not see straight, or report the facts without addition or diminution. There is plenty that is curious and inexplicable in nature, things that astonish or baffle us, but there is no "hocus-pocus," nothing that moves on the border-land between the known and the unknown, or that justifies the curious superstitions of the past. Things of the twilight are more elusive and difficult of verification than things of the noon, but they are no less real, and no less a part of the common day

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I was reminded of this lately on hearing the twilight flight song of the woodcock — one of the most curious and tantalizing yet interesting bird songs we have. I fancy that the persons who hear and recognize it in the April or May twilight are few and far between. I myself have heard it only on three occasions — one season in late March, one season in April, and the last time in the middle of May. It is a voice of ecstatic song coming down from the upper air and through the mist and the darkness — the spirit of the swamp and the marsh climbing heavenward and pouring out its joy in a wild burst of lyric melody; a haunter of the muck and a prober of the mud suddenly transformed into a bird that soars and circles and warbles like a lark hidden or half hidden in the depths of the twilight sky. The passion of the spring has few more pleasing exemplars. The madness of the season, the abandon of the mating instinct, is in every move and note. Ordinarily the woodcock is a very dull, stupid bird, with a look almost idiotic, and is seldom seen except by the sportsman or the trampler along marshy brooks. But for a brief season in his life he is an inspired creature, a winged song that baffles the eye and thrills the ear from the mystic regions of the upper air.

When I last heard it, I was with a companion, and our attention was arrested, as we were skirting the edge of a sloping, rather marshy, boulder-strewn

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field, by the "zeep," "zeep," which the bird utters on the ground, preliminary to its lark-like flight. We paused and listened. The light of day was fast failing; a faint murmur went up from the fields below us that defined itself now and then in the good-night song of some bird. Now it was the lullaby of the song sparrow or the swamp sparrow. Once the tender, ringing, infantile voice of the bush sparrow stood out vividly for a moment on that great background of silence. "Zeep," "zeep," came out of the dimness six or eight rods away. Presently there was a faint, rapid whistling of wings, and my companion said: "There, he is up." The ear could trace his flight, but not the eye. In less than a minute the straining ear failed to catch any sound, and we knew he had reached his climax and was circling. Once we distinctly saw him whirling far above us. Then he was lost in the obscurity, and in a few seconds there rained down upon us the notes of his ecstatic song — a novel kind of hurried, chirping, smacking warble. It was very brief, and when it ceased, we knew the bird was dropping plummet-like to the earth. In half a minute or less his "zeep," "zeep," came up again from the ground. In two or three minutes he repeated his flight and song, and thus kept it up during the half-hour or more that we remained to listen: now a harsh plaint out of the obscurity upon the ground; then a jubilant strain from out the obscurity of the air above. His mate was probably

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somewhere within earshot, and we wondered just how much interest she took in the performance. Was it all for her benefit, or inspired by her presence? I think, rather, it was inspired by the May night, by the springing grass, by the unfolding leaves, by the apple bloom, by the passion of joy and love that thrills through nature at this season. An hour or two before, we had seen the bobolinks in the meadow beating the air with the same excited wing and overflowing with the same ecstasy of song, but their demure, retiring, and indifferent mates were nowhere to be seen. It would seem as if the male bird sang, not to win his mate, but to celebrate the winning, to invoke the young who are not yet born, and to express the joy of love which is at the heart of nature.

When I reached home, I went over the fourteen volumes of Thoreau's Journal to see if he had made any record of having heard the "woodcock's evening hymn," as Emerson calls it. He had not. Evidently he never heard it, which is the more surprising as he was abroad in the fields and marshes and woods at almost all hours in the twenty-four and in all seasons and weathers, making it the business of his life to see and record what was going on in nature.

Thoreau's eye was much more reliable than his ear. He saw straight, but did not always hear straight. For instance, he seems always to have

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confounded the song of the hermit thrush with that of the wood thrush. He records having heard the latter even in April, but never the former. In the Maine woods and on Monadnock it is always the wood thrush which he hears, and never the hermit.

But if Thoreau's ear was sometimes at fault, I do not recall that his eye ever was, while his mind was always honest. He had an instinct for the truth, and while we may admit that the truth he was in quest of in nature was not always scientific truth, or the truth of natural history, but was often the truth of the poet and the mystic, yet he was very careful about his facts; he liked to be able to make an exact statement, to clinch his observations by going again and again to the spot. He never taxes your credulity. He had never been bitten by the mad dog of sensationalism that has bitten certain of our later nature writers.

Thoreau made no effort to humanize the animals. What he aimed mainly to do was to invest his account of them with literary charm, not by imputing to them impossible things, but by describing them in a way impossible to a less poetic nature. The novel and the surprising are not in the act of the bird or beast itself, but in Thoreau's way of telling what it did. To draw upon your imagination for your facts is one thing; to draw upon your imagination in describing what you see is quite another. The new school of nature writers will afford many

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samples of the former method; read Thoreau's description of the wood thrush's song or the bobolink's song, or his account of wild apples, or of his life at Walden Pond, or almost any other bit of his writing, for a sample of the latter. In his best work he uses language in the imaginative way of the poet.

Literature and science do not differ in matters of fact, but in spirit and method. There is no live literature without a play of personality, and there is no exact science without the clear, white light of the understanding. What we want, and have a right to expect, of the literary naturalist is that his statement shall have both truth and charm, but we do not want the charm at the expense of the truth. I may invest the commonest fact I observe in the fields or by the roadside with the air of romance, if I can, but I am not to put the romance in place of the fact. If you romance about the animals, you must do so unequivocally, as Kipling does and as Æsop did; the fiction must declare itself at once, or the work is vicious. To make literature out of natural history observation is not to pervert or distort the facts, or to draw the long bow at all; it is to see the facts in their true relations and proportions and with honest emotion.

Truth of seeing and truth of feeling are the main requisite: add truth of style, and the thing is done.

VII

HUMAN TRAITS IN THE ANIMALS

THAT there is a deal of human nature in the lower animals is a very obvious fact; or we may turn the proposition around and say, with equal truth, that there is a deal of animal nature in us humans. If man is of animal origin, as we are now all coming to believe, how could this be otherwise? We are all made of one stuff, the functions of our bodies are practically the same, and the workings of our instincts and our emotional and involuntary natures are in many ways identical. I am not now thinking of any part or lot which the lower orders may have in our intellectual or moral life, a point upon which, as my reader may know, I diverge from the popular conception of these matters, but of the extent in which they share with us the ground or basement story of the house of life — certain fundamental traits, instincts, and blind gropings.

Man is a bundle of instincts, impulses, predilections, race and family affinities, and antagonisms, supplemented by the gift of reason — a gift of which he sometimes makes use. The animal is

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a bundle of instincts, impulses, affinities, appetites, and race traits, without the extra gift of reason.

The animal has sensation, perception, and power of association, and these suffice it. Man has sensation, perception, memory, comparison, ideality, judgment, and the like, which suffice him.

There can be no dispute, I suppose, as to certain emotions and impulses being exclusively human, such as awe, veneration, humility, reverence, self-sacrifice, shame, modesty, and many others that are characteristic of what we call our moral nature. Then there are certain others that we share with our dumb neighbors — curiosity, jealousy, joy, anger, sex love, the maternal and paternal instinct, the instinct of fear, of self-preservation, and so forth.

There is at least one instinct or faculty that the animals have far more fully developed than we have — the homing instinct, which seems to imply a sense of direction that we have not. We have lost it because we have other faculties to take its place, just as we have lost that acute sense of smell that is so marvelously developed in many of the four-footed creatures. It has long been a contention of mine that the animals all possess the knowledge and intelligence which is necessary to their self-preservation and the perpetuity of the species, and that is about all. This homing instinct seems to be one of the special powers that the animals cannot get along without. If the solitary wasp, for instance,

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could not find her way back to that minute spot in the field where her nest is made, a feat quite impossible to you or me, so indistinguishable to our eye is that square inch of ground in which her hole is made; or if the fur seal could not in spring retrace its course to the islands upon which it breeds, through a thousand leagues of pathless sea water, how soon the tribe of each would perish!

The animal is, like the skater, a marvel of skill in one field or element, or in certain fixed conditions, while man's varied but less specialized powers make him at home in many fields. Some of the animals outsee man, outsmell him, outhear him, outrun him, outswim him, because their lives depend more upon these special powers than his does; but he can outwit them all because he has the resourcefulness of reason, and is at home in many different fields. The condor "houses herself with the sky" that she may have a high point of observation for the exercise of that marvelous power of vision. An object in the landscape beneath that would escape the human eye is revealed to the soaring buzzard. It stands these birds in hand to see thus sharply; their dinner depends upon it. If mine depended upon such powers of vision, in the course of time I might come to possess it. I am not certain but that we have lost another power that I suspect the lower animals possess — something analogous to, or identical with, what we call telepathy — power to

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communicate without words, or signs, or signals. There are many things in animal life, such as the precise concert of action among flocks of birds and fishes and insects, and, at times, the unity of impulse among land animals, that give support to the notion that the wild creatures in some way come to share one another's mental or emotional states to a degree and in a way that we know little or nothing of. It seems important to their well-being that they should have such a gift — something to make good to them the want of language and mental concepts, and insure unity of action in the tribe. Their seasonal migrations from one part of the country to another are no doubt the promptings of an inborn instinct called into action in all by the recurrence of the same outward conditions; but the movements of the flock or the school seem to imply a common impulse that is awakened on the instant in each member of the flock. The animals have no systems or methods in the sense that we have, but like conditions with them always awaken like impulses, and unity of action is reached without outward communication.

The lower animals seem to have certain of our foibles, and antagonisms, and unreasoning petulancies. I was reminded of this in reading the story President Roosevelt tells of a Colorado bear he once watched at close quarters. The bear was fussing around a carcass of a deer, preparatory to burying

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it "Once the bear lost his grip and rolled over during the course of some movement, and this made him angry and he struck the carcass a savage whack, just as a pettish child will strike a table against which it has knocked itself." Who does not recognize that trait in himself: the disposition to vent one's anger upon inanimate things — upon his hat, for instance, when the wind snatches it off his head and drops it in the mud or leads him a chase for it across the street; or upon the stick that tripped him up, or the beam against which he bumped his head? We do not all carry our anger so far as did a little three-year-old maiden I heard of, who, on tripping over the rockers of her chair, promptly picked herself up, and carrying the chair to a closet, pushed it in and spitefully shut the door on it, leaving it alone in the dark to repent its wrong-doing.

Our blind, unreasoning animal anger is excited by whatever opposes or baffles us. Of course, when we yield to the anger, we do not act as reasonable beings, but as the unreasoning animals. It is hard for one to control this feeling when the opposition comes from some living creature, as a balky horse or a kicking cow, or a pig that will not be driven through the open gate. When I was a boy, I once saw one of my uncles kick a hive of bees off the stand and halfway across the yard, because the bees stung him when he was about to "take them

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up." I confess to a fair share of this petulant, unreasoning animal or human trait, whichever it may be, myself. It is difficult for me to refrain from jumping upon my hat when, in my pursuit of it across the street, it has escaped me two or three times just as I was about to put my hand upon it, and as for a balky horse or a kicking cow, I never could trust myself to deal reasonably with them. Follow this feeling back a few thousand years, and we reach the time when our forbears looked upon all the forces in nature as in league against them. The anger of the gods as shown in storms and winds and pestilence and defeat is a phase of the same feeling. A wild animal caught in a steel trap vents its wrath upon the bushes and sticks and trees and rocks within its reach. Something is to blame, something baffles it and gives it pain, and its teeth and claws seek every near object. Of course it is a blind manifestation of the instinct of self-defense, just as was my uncle's act when he kicked over his beehive, or as is the angler's impatience when his line gets tangled and his hook gets fast. If the Colorado bear caught his fish with a hook and line, how many times would he lose his temper during the day!

I do not think many animals show their kinship to us by exhibiting the trait I am here discussing. Probably birds do not show it at all. I have seen a nest-building robin baffled and delayed, day after day, by the wind that swept away the straws and

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rubbish she carried to the top of a timber under my porch. But she did not seem to lose her temper. She did not spitefully reclaim the straws and strings that would persist in falling to the porch floors, but cheerfully went away in search of more. So I have seen a wood thrush time after time carrying the same piece of paper to a branch from which the breeze dislodged it, without any evidence of impatience. It is true that when a string or a horsehair which a bird is carrying to its nest gets caught in a branch, the bird tugs at it again and again to free it from entanglement, but I have never seen any evidence of impatience or spite against branch or string, as would be pretty sure to be the case did my string show such a spirit of perversity. Why your dog bites the stone which you roll for him when he has found it, or gnaws the stick you throw, is not quite clear, unless it be from the instinct of his primitive ancestors to bite and kill the game run down in the chase. Or is the dog trying to punish the stick or stone because it will not roll or fly for him? The dog is often quick to resent a kick, be it from man or beast, but I have never known him to show anger at the door that slammed to and hit him. Probably, if the door held him by his tail or his limb, it would quickly receive the imprint of his teeth.

In reading Bostock on the "Training of Wild Animals," my attention was arrested by the remark

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that his performing lions and tigers are liable to suffer from "stage fright," like ordinary mortals, but that "once thoroughly accustomed to the stage, they seem to find in it a sort of intoxication well known to a species higher in the order of nature;" and furthermore, that "nearly all trainers assert that animals are affected by the attitude of an audience, that they are stimulated by the applause of an enthusiastic house, and perform indifferently before a cold audience." If all this is not mere fancy, but is really a fact capable of verification, it shows another human trait in animals that one would not expect to find there. Bears seem to show more human nature than most other animals. Bostock says that they evidently love to show off before an audience: "The conceit and good opinion of themselves, which some performing bears have, is absolutely ridiculous." A trainer once trained a young bear to climb a ladder and set free the American flag, and so proud did the bear become of his accomplishment, that whenever any one was looking on he would go through the whole performance by himself, "evidently simply for the pleasure of doing it." Of course there is room for much fancy here on the part of the spectator, but bears are in so many ways — in their play, in their boxing, in their walking — such grotesque parodies of man, that one is induced to accept the trainer's statements as containing a measure of truth.

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The preëminent danger of the animal trainer comes under the same conditions that it would probably come to him were he a trainer of wild men, to wit, when he stumbles or falls. In such a case, the lion or tiger is very apt to spring upon him. These beasts seem to know that a man is less formidable when down than when standing; when prone upon the ground, his power has departed. They also, like the human savage, often seize the opportunity for an attack upon him when his back is turned. A bold, threatening front cows an animal as it cows a man. The least sign of fear or of hesitation on the part of the trainer, and he is in danger. Self-confidence, self-control, an authoritative manner, count for just as much in our dealing with the animals as with men. How a bold, unhesitating manner will carry you through a pack of threatening dogs, while timidity or parleying endangers your calves! Act as though you were the rightful master of the place and had come to give orders, and the most threatening watch-dog gives way. Flee from a mad bull, a cross dog, a butting sheep, and your danger is vastly increased. Even an insolent rooster or a bellicose gander will strike you then. I have found that the best way to deal with the hive bee is by a bold and decisive manner. I would even recommend the same course with yellow-jackets; if you are bent on demolishing their nest, do it by a sudden bold stroke, and not by timid approaches

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All kinds of bees seem disconcerted by a sudden onslaught.

Another human trait that seems almost universal among the lower animals is the coyness and reluctance of the female in her relations to the male. Her first impulse is to refuse and to flee. She is negative as the male is positive. Among the birds there is something like regular courtship, there is rivalry and jealousy and hostile collision on the part of both sexes. With the birds, the propagating instinct in the female is evidently not subject to the same law of recurring intervals that it is among mammals. Hence the female must be stimulated and won by the male. He addresses himself to her in a way that is quite exceptional, if it occurs at all, among mammals. His aim seems to be to kindle or quicken her sexual and mating impulses. In the case of mammals, these impulses recur at certain periods, and no courtship on the part of the male is necessary.

Just what part the gay plumes and the extra appendages of the males play in bird courtship I have discussed elsewhere. I think it is highly probable that the bright colors and ornamental plumes of the male react upon him, excite him, and increase his pride, his courage, and the impetuosity of his address. The birds that dance and perform before the females, during the breeding season, seem to show more and more excitement as the dance proceeds, apparently intoxicated by their own ardor. Just

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what determines the choice of the male and sets him in pursuit of a particular female is a question that greatly interests me. Does the matter turn upon some complementary variation too subtle for us to perceive? The mating of birds certainly seems like an act of choice; but just what determines it, how shall we find that out? Behold the sparrows in the street, three or four males apparently in a scrimmage with one female, surrounding her and playfully assaulting her, with spread plumage and animated chirping and chattering, while she, the centre of the group, strikes right and left, in a serious, angry mood, at her would-be suitors. What does it mean? Or, the robins in the spring, rushing across the lawn and forming sudden rough-and-tumble groups with a struggling and indignant female in the centre, or gleefully screaming, and quickly and apparently amicably separating? In all such cases the hen bird alone wears an angry and insulted air. What indignity has been put upon her? I know of nothing in human courtship analogous to this tumultuous and hilarious pursuit of the females by the cock sparrows and robins.

The gregarious instinct of birds and mammals does not differ essentially, as I see, from the same instinct in man, except that in man it is often for coöperation or mutual protection, while with the lower animals it seems purely social. Many birds flock in the fall and winter that live in pairs during

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the summer. Crows, for instance, have their rookeries, where vast numbers congregate to pass the winter nights, and they usually keep in bands or loose flocks during the winter days. Apparently, this clannishness in winter is for social cheer and good-fellowship alone. As they roost in naked, exposed treetops, they could not, it seems to me, perceptibly shield one another from the cold; while it is reasonable to think that the greater scarcity of food at this season would naturally cause them to scatter. But the centripetal force, so to speak, of the social instinct, triumphs over all else. Many species of our birds flock in the fall — the various blackbirds, the cedar-birds, the goldfinches, the siskins, the snowbirds, the tree and bank swallows; to say nothing of the waterfowl — some to migrate and some to pass the winter here. In similar conditions or similar stress of circumstances, human beings would probably act in a similar way; we should migrate in herds, or face some common calamity in large aggregates.

Indeed, the social instinct seems radically the same in all forms of animal life. The loneliness of a domestic animal separated from the herd, the homesickness of a dog or a horse when removed to a strange place, do not seem to differ very much from the feelings we experience under like circumstances. Attachment to places, attachment to persons, attachment to one another, to home and to

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mate — these feelings seem about the same in kind among all creatures. Of course they are more complex, far-reaching, and abiding in man than in the animals below him, but their genesis seems the same.

Among both birds and four-footed beasts, the maternal affection is doubtless greater than the paternal, and this also is human. But how brief and fugitive the affection is, compared with the same attachment in our own species! — of a few weeks' duration among our common birds, and a few months or a year among the mammals, but always as long as the well-being of the young requires it. When they become self-supporting, the parental affection ceases. And in a limited sense this is true in our own case.

If a bird loses its mate during the breeding season, the period of mourning and waiting is very brief, usually not more than a day or two. The need of rearing a family is urgent, and nature wastes no time in unavailing regrets. Just how the bereaved mate makes her or his wants known, I never could find out; but it seems there are always not far off some unmated birds of both sexes that are ready to step in and complete the circle once more. From sparrows to eagles, this seems to be the rule.

With what species, if any, the marriage unions last during life, I do not know. Neither do I know

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if anything like divorce, or unfaithfulness, or free love, ever takes place among the monogamous birds — probably not. The riot of the breeding instinct in the males confines itself to gay plumes, or songs, or grotesque antics, while the seriousness and preoccupation of the female, I doubt not, would prove an effectual warning to any gay Lotherio among her neighbors, if such there happened to be.

I am convinced that birds have a sense of home, or something analogous to it, and that they return year after year to the same localities to nest. The few cases where I have been able to identify the particular sparrow or robin or bluebird confirm me in this belief.

Hermits among the birds or beasts are probably very rare, and I doubt if voluntary seclusion ever occurs. Sometimes an old male, vanquished and in a measure disabled by his younger rivals, may be driven out of the herd or pack and compelled to spend the remainder of his days in comparative solitude. Or an old eagle that has lost its mate may spend its days henceforth alone. The birds of prey, like the animals of prey, and like prowlers and bloodsuckers generally, are solitary in their habits.

The feeling of hostility towards strangers that all animals manifest in varying degrees, how distinctly we can trace it up through the savage races and through the lower orders of our social aggre-

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gates, till it quite fades out in the more highly civilized communities!

Animals experience grief over the loss of their young, but not over the death of a member of their flock or tribe. Death itself seems to have no meaning to them. When a bird seems to mourn for its lost mate, its act is probably the outcry of the breeding instinct which has been thwarted.

Do the birds and mammals sympathize with one another? When one bird utters a cry of distress, the birds of other species within hearing will hasten to the spot and join in the cry — at least in the breeding season. I have no proof that they will do it at other times. And I do not call this sympathy, but simply the alarm of the parental instinct, which at this season is very sensitive. The alarm-cry of many birds will often put four-footed animals on the lookout. The language of distress and alarm is a universal language, which all creatures understand more or less. But I doubt if sympathy as we know it — the keen appreciation of the suffering or the misfortune of another, which implies power in a measure to put ourselves in that other's place — even in its rudimentary form, exists among the lower orders. Among the domestic fowls, a cry of distress from one of them usually alarms the others: a cry from a chicken brings the mother hen to the rescue; this is the maternal instinct, and the instinct of self-preservation which all animals must have or

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their race would perish. A certain agonized call from a member of a herd of cattle will at once bring the other members to the spot, with uplifted heads and threatening horns. This, again, is the instinct of self-preservation. This, I say, animals must have, but they do not have to have sympathy any more than they have to have veneration, or humility, or the æsthetic sense. But fear — think how important this is to them — blind, unreasoning fear, but always alert and suspicious.

Fear in the human species is undoubtedly of animal origin. How acute it often is in young children — the fear of the dark, of the big, of the strange, and of the unusual! The first fear I myself remember was that of an open door at night leading into a dark room. What a horror I felt at that mysterious cavernous darkness! — and this without any idea of the danger that might lurk there. The next fear I recall was a kind of panic, when I was probably three or four years of age, at the sight of a hen-hawk sailing against the sky above me. I hurriedly climbed over the wall and hid behind it. Later, when I was ten or twelve years of age, my fear took a less animal form — a fear of spooks and hobgoblins, induced, no doubt, by the fearsome superstitions of my elders. Now I am not conscious of any physical or superstitious fears, but there is plenty of moral cowardice left. My little granddaughter, when two and a half years old, was

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filled with terror of the sea as she saw it for the first time from the beach.

Fear seems to have the same effect upon both man and beast, causing trembling of the muscles, a rapid beating of the heart, a relaxation of the sphincters, momentary weakness, confusion, panic, flight. It would be interesting to know if the blood leaves the capillaries in the faces of animals during sudden fright, as it does in man, producing paleness.

The panic that sometimes seizes a multitude of animals, resulting in a stampede, a blind, furious rush away from the real or the imaginary danger, seems to differ but little from that which at times seizes the human multitude in theatre, or circus, or on the field of battle. It is a kind of madness, augmented and intensified by numbers. The contagion of fear works among all creatures, like the contagion of joy, or anger, or any other sudden impulse. These things are "catching;" an emotional state in one man or one animal tends to beget the same state in all other near-by men or animals, either through imitation, or through some psychic law not well understood. Like begets like throughout nature. Just as our bodily temperature rises in a crowd, so does that psychic state become more acute in which we are liable to sudden enthusiasms or panic, fear or animal cruelty. Mobs are guilty of things, especially in the way of violence, that the separate members of them would never think of

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doing, just as nations and corporations will exhibit a meanness and hoggishness that would shame the individuals composing them.

It is a question whether or not the lower animals ever experience the feeling we know as revenge — that they cherish a hatred or a secret enmity toward one of their own kind or toward a person, in the absence of that person or fellow. Their power of association, which is undoubted, would call up the old anger on the sight of an object that had injured them, but they probably do not in the meantime carry any feeling of ill-will as we do, because they do not form mental concepts. And yet I have known things to happen that point that way. It is well known that the blue jay destroys the eggs of other birds. One day I found a nest of a blue jay with its five eggs freshly punctured — each egg with a small hole in it as if made by the beak of a small bird, as it doubtless had been. Was this revenge on the part of some victim of the jay's? One can only conjecture. Roosevelt tells this curiously human anecdote of a bear. A female grizzly was found by a hunter lying across a game trail in the woods. The hunter shot the bear as she was about to charge him, and on examining the spot where she had been lying, he found that it was the freshly made grave of her cub. He conjectured that a male grizzly or a cougar had killed the cub in the absence of the mother, and that on her return she had buried it,

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and had lain down upon the grave waiting to wreak her vengeance upon the murderer of her young. But this may be only the plausible human interpretation of the fact. Just what the bear's state of mind was, we have no means of knowing.

The dog undoubtedly exhibits more human traits than any other lower animal, and this by reason of his long association with man. There are few of our ordinary emotions that the dog does not share, as joy, fun, love of adventure, jealousy, suspicion, comradeship, helpfulness, guilt, covetousness, and the like, or feelings analogous to these — the dog version of them. I am not sure but that the dog is capable of contempt. The behavior at times of a large dog toward a small, the slights he will put upon him, even ejecting his urine upon him, is hardly capable of any other interpretation. The forbearance, too, which a large dog usually shows toward a touchy little whiffet, never resenting its impudent attacks, is very human. "A barking dog never bites" is an old saying founded upon human nature as well as upon dog nature. The noisy blusterer is rarely dangerous, whether man or dog. I do not agree with Stevenson that the dog is a snob. The key to a dog's heart is kindness. He will always meet you halfway and more. I have been asked why the farm dog usually shows such hostility to tramps and all disreputable-looking persons. It is not their looks that disturb the dog, but

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their smell — a strange, unknown odor. This at once puts him on his guard and excites his enmity. There is little speculation in the eye of a dog, but his nose is keen and analytical.

The dog, through his long intercourse with man, has become charged with our human quality, as steel is charged by a magnet. Yet I am told that a tame wolf or a tame fox fawns and wags his tail and tries to lick his master's face, the same as the dog. At any rate, the dog does many things that we can name only in terms applicable to ourselves. My dog coaxes me to go for a walk, he coaxes me to get upon my lap, he coaxes for the food I am eating. When I upbraid him, he looks repentant and humiliated. When I whip him, he cries, when I praise him, he bounds, when I greet him in the morning, he whines with joy. It is not the words that count with him, it is the tone of the voice.

When I start out for a walk, he waits and dances about till he sees which way I am going. It seems as if he must at such times have some sort of mental process similar to my own under like circumstances. Or is his whole behavior automatic — his attitude of eagerness, expectancy, inquiry, and all? as automatic as the wagging of his tail when he is pleased, or as his bristling up when he is angry? It evinces some sort of mental action, but the nature of it is hard to divine. When he sits looking vaguely out upon the landscape, or rests his chin upon his paws

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and gazes into the fire, I wish I knew if there were anything like currents of thought, or reminiscences, or anticipations passing through his mind. When I speak sternly to him and he cowers down or throws himself on his back and puts up his paws pleadingly, I wish I knew just the state of his mind then. One day my dog deserted me while I was hunting, and when I returned, and before I had spoken a word to him, he came creeping up to me in the most abject way, threw himself over, and put up his pleading paws, as if begging forgiveness. Was he? We should call it that in a person. Yet I remember that I upbraided him when he first showed the inclination to desert me, and that fact may account for his subsequent behavior.

When you speak to your dog in a certain way, why does he come up to you and put out his front legs and stretch, and then stretch his hind legs, and maybe open his mouth and gape? Is it an affectation, or a little embarrassment because he does not know what you are saying? All dogs do it. The human traits of the dog are very obvious. One time I drove many miles through the country with my small mongrel black and tan dog Lark with me, often on the seat by my side. When he was in the wagon and other dogs came out and barked at us, Lark was very brave and answered back defiantly and threateningly; but when he was upon the ground and other dogs came out, Lark was as meek

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and non-resisting as a Quaker. Then let me take him up out of harm's way, and see how his tone would change, and what a setting-out he would give those dogs!

I do not believe that animals ever commit suicide. I do not believe that they have any notions of death, or take any note of time, or ever put up any "bluff game," or ever deliberate together, or form plans, or forecast the seasons. They may practice deception, as when a bird feigns lameness or paralysis to decoy you away from her nest, but this of course is instinctive and not conscious deception. There is on occasion something that suggests coöperation among them, as when wolves hunt in relays, as they are said to do, or when they hunt in couples, one engaging the quarry in front, while the other assaults it from the rear; or when quail roost upon the ground in a ring, their tails to the centre, their heads outward; or when cattle or horses form a circle when attacked in the open by wild beasts, the cattle with their heads outward, and the horses with their heels. Of course all this is instinctive, and not the result of deliberation. The horse always turns his tail to the storm as well, and cows and steers, if I remember rightly, turn their heads.

A family of beavers work together in building their dam, but whether or not they combine their strength upon any one object and thus achieve unitedly what they could not singly, I do not know.

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Of course among the bees there is coöperation and division of labor, but how much conscious intelligence enters into the matter is beyond finding out.

Leadership among the animals, when it occurs, as among savage tribes, usually falls to the strong, to the most capable. And such leaders are self-elected: there is nothing like a democracy in the animal world. Troops of wild horses are said always to have a leader, and it is probable that bands of elk and reindeer do also. Flocks of migrating geese and swans are supposed to be led by the strongest old males; but among our flocking small birds I have never been able to discover anything like leadership. The whole flock acts as a unit, and performs its astonishing evolutions without leaders or signals.

In my youth, upon the farm, I observed that in a dairy of cows there was always one master cow, one to whose authoritative sniff, or gesture, or thrust, all others yielded, and she was usually the most quiet and peaceful cow in the herd.

The male animal, as compared with the female, is usually the more aggressive and domineering, except among birds of prey, where the reverse is true. Roosevelt says that a band of antelope, as of elk and deer, is ordinarily led by an old doe, but that when danger threatens, a buck may spring to the leadership.

In the breeding season the pronghorn buck has

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his harems — all the does he can steal or cajole or capture from his rivals. "I have seen a comparatively young buck," says Roosevelt, "who had appropriated a doe, hustle her hastily out of the country as soon as he saw another antelope in the neighborhood; while on the other hand, a big buck, already with a good herd of does, will do his best to appropriate any other that comes in sight."

On the seal islands of Alaska we saw many old bull seals with their harems about them — a dozen or more demure-looking females resting upon low bowlders, while their lord and master sat perched above them on a higher rock. The defeated males, too young or too old to hold their own against their rivals, hung in ill-humored dejection about the neighborhood. I have read that on the Pampas in South America, wild stallions will capture and hurry away domestic mares, if they have a chance.

Animals are undoubtedly capable of feeling what we call worry and anxiety just as distinctly as they feel alarm or joy, only, of course, these emotions are much more complex in man. How the mother bird seems to worry as you near her nest or her young; how uneasy the cow is when separated from her calf, or the dog when he has lost his master! Do these dumb kindred of ours experience doubts and longings and suspicions and disappointments and hopes deferred just as we do? — the same in kind, if not in degree?

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The sheer agony or terror which an animal is capable of feeling always excites our pity. Roosevelt tells of once coming upon a deer in snow so deep that its efforts to flee were fruitless. As he came alongside of it, of course to pass it by untouched, it fell over on its side and bleated in terror. When John Muir and his dog Stickeen, at the imminent peril of their lives, at last got over that terrible crevasse in the Alaska glacier, the dog's demonstrations of joy were very touching. He raced and bounded and cut capers and barked and felicitated himself and his master as only a dog can.

The play of animals seems strictly analogous to the play of man, and I have no doubt that the reason of the one, whatever that be, is the reason of the other. Whether play is to be accounted for upon the theory of surplus energy, as Spencer maintains, or upon the theory of instinctive training and development — a sort of natural, spontaneous school or kindergarten that has reference to the future wants of the animal, as the German psychologist Karl Groos argues — a biological conception of play — its genesis is no doubt the same both in man and beast. The main difference is that the play of one is aimless and haphazard, while that of the other has method and purpose. Animals have no rules or systems, and yet I have often seen two red squirrels engaged in what seemed precisely analogous to the boys' game of tag. Up and down and

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from tree to tree they would go, until one of them overtook the other, when it seemed to become its turn to flee and be pursued. But just how much method there is in such a game, it is impossible to determine. In all cases, the play of animals tends to develop those powers of speed, or agility, or strength that their ways of living call for. The spirit of play gradually leaves an animal at maturity, as it leaves man.

A trait alike common to man and beast is imitativeness; both are naturally inclined to do what they see their fellows do. The younger children imitate the elder, the elder imitate their parents, their parents imitate their neighbors. The young writer imitates the old, the young artist copies the master. We catch the trick of speech or the accent of those we much associate with; we probably, in a measure, even catch their looks. Any fashion of dress or equipage is as catching as the measles. We are more or less copyists all our lives. Among the animals, the young do what they see their parents do; this, I am convinced, is all there is of parental instruction among them; the young unconsciously follow the example of their elders. The bird learns the song of its parent. If it never hears this song, it may develop a song of its own—like its parent's song in quality, of course, but unlike it in form. Or it may acquire the song of some other species.

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Darwin thinks that birds have "nearly the same taste for the beautiful as we have," except, of course, that in man "the sense of beauty is manifestly a more complex feeling and is associated with various intellectual ideas." It seems to me that if we mean by taste the appreciation of the beautiful, it is as distinctly a human gift as reason is, or as is the sense of humor, or the perception of the spiritual and the ideal. Shall we say the lilies of the field have taste because Solomon in all his glory was not arrayed like one of these? or that the trees have taste because of their grace and beauty of form? or the insects because of their many beautiful colors and patterns? I doubt if the æsthetic feeling is even rudimentary in birds, any more than are our moral and other intellectual traits. It is thought that the male bird sings to charm the female. Are such discordant notes, then, as the gobble of the turkey, the crowing of the cock, the scream of the peacock or of the guinea hen, to charm the female? When the rooster crows, the nearby hens shake their heads as if the sound pained them, as doubtless it does.

Why, then, do birds sing? Is it from a love of beautiful sounds? I can only answer that it seems to be a trait inherent in the male sexual principle, as much so as are gay plumes and ornamental appendages; it is one of the secondary sexual characteristics. It is very significant that the sweetest

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songsters to our ears are, as a rule, of the plainest colors and free from extra plumes and ornaments. I have yet to discover any evidence of pleasure on the part of the female in the songs of her male suitors. The male does not even sing for his own ear; if he did, when his vocal powers are defective, as is sometimes the case, he would quit singing. But such is not the case; he sings because he has the impulse to sing, and that is reason enough.

I know but one fact in the life of our birds that suggests anything like taste. I refer to the nesting-habits of the hummingbird, and of the little blue-gray gnatcatcher and the wood pewee. The nests of these birds are always neatly thatched with lichens, thus perfectly realizing the dream of the true domestic architect, of making the structure blend with its surroundings. The nests of nearly all birds blend well with their surroundings, because the material at hand is itself of a dull, neutral character. But the lichens which the hummer and the gnatcatcher and our wood pewee use seem, at first sight, an extra touch. Yet I cannot credit it to taste or to the love of the beautiful, because it is beautiful only to the cultivated, artistic taste of man. To a savage, or even to those much higher in civilization, it would not appear beautiful. A certain degree of culture has to be reached before we find beauty in these quieter things. The reason why these birds thatch the outside of their nests with lichens is

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doubtless this : the nests are built of a kind of down that would render them very frail and pervious to the rain were they not stayed and thatched with some firmer material. The lichens and spiders' webs bind them together and keep them in shape. Hence I should say that utility alone governed the bird in this use of lichens. Bright objects attract children, attract birds, attract quadrupeds, but this attraction is far enough from what we mean by taste or the love of the beautiful.

VIII

ANIMAL AND PLANT INTELLIGENCE

I

WHEN I hear a person expatiating on the reasoning powers of the lower animals, as I very often do, I want to tell him of the wonderful reasoning powers of the flies that pester our cow in summer. Those flies have measured the length of the old cow's tail so accurately that they know the precise spot on her body where the tail cannot reach them; on these spots they settle and torment her. Their behavior reveals great powers of calculation and reasoning. By what means they measured the swing of that tail so accurately I do not know. When I come slying up with a switch in my hand, they dart away before I can get in a stroke, because they know I can reach them; they take the measure of my arm and switch on the instant — on the fly, as it were. And what shall we say of the mosquito that so quickly finds out the vulnerable parts of one's clothing? If one chances to be wearing low shoes, does she not know at a glance where to strike, though she may never have seen low shoes before?

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Now is not that reasoning just as good as much of the reasoning that the public indulges in upon these subjects? Or, take the wit of the old cow herself. Yonder is a very steep hillside, the high, abrupt bank of an old river terrace. Along this bank the cattle have made a series of parallel paths, level as the top of the terrace itself. The paths, I should think, are about four feet apart, just far enough so that the cow walking along one of them can graze at her ease over all the strip of ground that lies between it and the next path. When she comes to the end, she steps up into the path above and repeats the process, and so on till the whole side of the terrace has been grazed over. Does not this show that the cow is very level-headed, that she can meet a difficult problem and solve it as rationally as you or I? Without the paths, how awkward and difficult the grazing would be! Now it is done easily because it is done from level paths; it is done thoroughly because it is done systematically. If you or I were going to search that hillside over daily, should not we adopt similar or identical tactics?

In Idaho I saw that the grazing sheep had terraced the grassy mountain-sides in the same way. Their level paths were visible from afar. How inevitable and free from calculation it all is! The grazing cattle take the easiest way, and this way is horizontally along the face of the hill. To take the

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hill by a straight climb or diagonally would be labor, so the animal moves easily along its side, cropping the grass within reach. Then she takes a step or two upward and grazes back the other way, and this process is repeated till a series of level parallel paths are worn in the side of the hill. They are as much a natural result as is the river terrace itself.

The cow has always been a famous engineer in laying out paths; sheep are, too. They take the line of least resistance; they ford the streams at the best places; they cross the mountains in the deep notches; they scale the hills by the easiest grade. Shall we, therefore, credit them with reason?

When I was a bucolic treasury clerk in Washington, the cow of an old Irishwoman near by used to peep through the cracks in my garden fence at my growing corn and cabbage till her mouth watered. Then she saw that a place in the fence yielded to me and let me in, so she tried it; she nudged the gate with her nose until she hit the latch, and the gate swung open by its own weight and let her in. There was an audible crunching of succulent leaves and stalks that soon attracted my attention. I hustled her out, and sent a kick after her that fell short and nearly unjointed my leg. But she was soon back, and she came again and again till I discovered her secret and repaired the latch so that nudging or

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butting the gate would not open it. How surely such conduct as this of the cow's evinces reason to most persons! But shall we not rather call it the blind gropings of instinct stimulated into action by the sight and odor of the tender vegetables? Many of the lowest organisms show just as much intelligence about their food as did the old cow. Even the American sundew, according to Mrs. Treat, will move its leaves so that it can seize a fly pinned half an inch from it. The method of the old cow was that of hit and miss, or trial and error. She wanted the corn, and she butted the gate, and as luck would have it, when she hit the latch the gate swung open. But shall we conclude that the beast had any idea of the principle of the gate? Or any idea at all but the sense impression made upon her hunger by the growing vegetables? Animals do not connect cause and effect as we do by thinking the "therefore;" they simply associate one thing with another. Your dog learns to associate your act of taking your hat and cane with a walk, or your gun with the delights of the chase, or with its report, if he is afraid of it, and so on. Without this power of association the birds and beasts could not get on in life; the continuity of their experience would be broken. It is a rude kind of memory — sense memory. A sense impression to-day revives a sense impression of yesterday, or of the day before, and that is about all there is of it.

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While I am telling tales on old Brindle, let me mention another point. Most farmers and country people think that the "giving down" or "holding up" of the milk by the cow is a voluntary act. In fact, they fancy that the udder is a vessel filled with milk, and that the cow releases it or withholds it just as she chooses. But the udder is a manufactory; it is filled with blood, from which the milk is manufactured while you milk. This process is controlled by the cow's nervous system. When she is excited or in any way disturbed, as by a stranger, or by the taking away of her calf, or any other cause, the process is arrested and the milk will not flow. The nervous energy goes elsewhere. The whole process is as involuntary as is digestion in man, and is disturbed or arrested in about the same way.

Why should we not credit the child with reason when it is learning to walk, and with a knowledge of the law of gravity? See how carefully it poises itself on the feet and adjusts itself to the pull of the invisible force. It is a natural philosopher from the cradle, and knows all about the necessity of keeping the centre of gravity within the base if it would avoid a fall! But there is probably less calculation in all this than there appears to be, since Huxley tells us that a frog with most of its brain removed will keep its position on the top of the hand while you slowly turn it over. It, too, feels the pull of gravity and knows all about the impor-

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tance of keeping the centre within the base. Throw this brainless frog into the water, and it swims as well as ever it did. Dan Beard, in his delightful "Animal Book," says that a rattlesnake which had just had its head cut off, coiled and struck him with the bloody stump when he touched it as promptly as it would have done with its head on. So it is doubtless true that all creatures do many reasonable and natural things without possessing the faculty of reason. Much of our own conduct in life is the result of this same unconscious, unreasoning obedience to natural forces or innate tendencies.

The English psychologist Hobhouse gives an account, in his work on "Mind and Evolution," of the experiments he tried with cats, dogs, monkeys, an otter, and an elephant, to test their intelligence. Their food was placed in boxes or jars, or tied to a string, in such ways that to get at it the animal had to do certain definite concrete things that it could not have been called upon to do in the ordinary course of its natural life, such as pulling strings, working levers, drawing bolts, lifting latches, opening drawers, upsetting jugs, always stimulated by the prospect of food. After many trials at the various tricks, a little gleam of intelligence seemed to pass through their minds. It was as if a man without power to move should finally feebly lift a hand or shake his head. The elephant was taught to pull a bolt and open the lid

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of a box only by her keeper taking her trunk in his hand and guiding it through each movement, stage by stage. She learned to pull the bolt on the seventh trial, but could not learn the three movements of drawing bolt, opening lid, and holding it open, till the fortieth trial, on the third day. Sometimes she tried to lift the lid before she drew the bolt, sometimes she pushed the bolt the wrong way. Another elephant learned to draw the bolt on the fourth trial. The otter learned to draw the bolt after seeing it drawn twelve times. Jack, the dog, learned to do the trick in his pawing, blundering way after many trials. A bolt furnished with a knob so that it could not be drawn all the way out worried all the animals a good deal. The dog had ninety lessons, and yet did not clearly understand the trick. The monkeys and the chimpanzee learned the different tricks more readily than the other animals, but there "appeared to be no essential difference in capacity to learn between the dogs, the elephants, the cats, and others." None of the animals seemed to appreciate the point of the trick, the dependence of one thing upon another, or the *why* of any particular movement. Poor things! their strenuous intellectual efforts in drawing a bolt or working a lever used to tire them very much. Sometimes, under the tutelage of their trainers, they would seem to show a gleam of real intelligence, as when you fan a dull ember till it glows a little. The

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next hour or the next day the ember had lost its glow and had to be fanned again. Yet they all did improve in doing their little "stunts," but how much was awakened intelligence, and how much mere force of habit, one could not be quite sure.

Hobhouse is no doubt right when he says that intelligence arises within the sphere of instinct, and that the former often modifies the action of the latter. The extent to which the lower animals profit by experience is a measure of their intelligence. If they hit upon new and improved ways spontaneously, or adapt new means to an end, they show a measure of intelligence. I once stopped up the entrance to a black hornets' nest with cotton. The hornets removed the cotton by chewing off the fibres that held it to the nest, and then proceeded to change the entrance by carrying it farther around toward the wall of the house, so that the feat of stopping it up was not so easy. Was this an act of intelligence, or only an evidence of the plasticity or resourcefulness of instinct? But if a dog in stalking a woodchuck (and I have been told of such things) at the critical moment were to rush to the woodchuck's hole so as to get there before it, this were an act of intelligence. To hunt and stalk is instinctive in the dog, but to correlate its act to that of its prey in this manner would show the triumph of intelligence over instinct.

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II

Huxley thought that because of the absence of language the brutes can have no trains of thought but only trains of feeling, and this is the opinion of most comparative psychologists. I am myself quite ready to admit that the lower animals come as near to reasoning as they come to having a language. Their various cries and calls — the call to the mate, to the young, the cry of anger, of fear, of alarm, of pain, of joy — do serve as the medium of some sort of communication, but they do not stand for ideas or mental concepts any more than the various cries of a child do. They are the result of simple reactions to outward objects or to inward wants, and do not imply any mental process whatever. A grown person may utter a cry of pain or fear or pleasure with a mind utterly blank of any ideas. Once on a moonlight night I lay in wait for some boy poachers in my vineyard. As I suddenly rose up, clad in a long black cloak, and rushed for one and seized his leg as he was hastening over the fence, he uttered a wild, agonized scream precisely as a wild animal does when suddenly seized. He told me afterward that he was fairly frightened out of his wits. For the moment he was simply an unreasoning animal.

A language has to be learned, but the animals all use their various calls and cries instinctively.

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What a clear case is that of the hen when she brings off her first brood! She speaks a language which she never spoke before, and her chickens hear a language which they never heard before, and understand it instantly. When the mother hen calls them, they come; when she utters her alarm-note, they hide, or run to her for protection.

The various calls and cries of the animals have just about the same significance as do their gestures of bristling, arching, pawing, and so on. They are understood by their fellows, and they are expressive of emotions and not of ideas. The loud cackling of a rooster which I hear as I write expresses in a vague way some excitement, pleasurable or otherwise. Or he may be signaling to the cackling hen to guide her to the flock, an instinct inherited from his jungle-fowl ancestors.

The parrot, of course, does not know the meaning of the words it repeats so glibly; it only associates certain sounds with certain acts or occasions, and says "Good-by," or "Come in," at the right time because it has been taught to connect these sounds with certain sense impressions through the eye and ear. When a child is in pain, it cries; when it is pleased, it laughs: always are its various sounds expressive of some immediate concrete want or experience. This is the character of all animal language; it does not express ideas, but feelings — emotions then and there experienced —

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the result of an inward impulse or an outward condition.

With ourselves, emotion arises spontaneously and is not the result of will. We cannot be angry, or joyous, or depressed, or experience the emotion of the beautiful, or of the sublime, or of love, or terror, by mere willing. These emotions arise under certain conditions that are not matters of will or calculation. If a man does not flee from danger, real or imaginary, like an animal, it is because his reason or his pride has stepped in and stopped him. Man's reason shows itself in checking or controlling his emotion, while the lower animals have no such check or stay. A man may think about the danger from which he flees, or about the scene that thrilled him, or of the woman that moved him, but the thinking always follows the emotion, while the horse or the dog flees without stopping to think.

Without doubt, to me at least, man has climbed up from some lower animal form, but he has, as it were, pulled the ladder up after him. None of man's humbler kindred, even if man were to reach them a hand, or a dozen hands, could now mount to the human plane.

As there must be a point back along the line of our descent where consciousness began — consciousness in the animal and self-consciousness in man — so there must be a point where reason began. If we had all the missing links in the chain,

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no doubt we might, approximately at least, determine the form in which it first dawned. The higher anthropoid apes, which are, probably, a lateral branch of the stem of the great biological tree that bore man, show occasional gleams of it, but reason, as we ascribe it to the lower orders, is more a kind of symptomatic reason, a vague foreshadowing of reason rather than the substance itself. For a long time the child is without reason, or any mental concepts, and all its activities are reactions to stimuli, like those of an animal; it is merely a bundle of instincts, but by and by it begins to show something higher and we hail the dawn of reason, and the child's development from the animal plane into the human.

The development of reason in the race of man has of course been as gradual as the development of his body from some lower animal form, but is it any more startling or miraculous than those slow transmutations or transformations which we trace everywhere in nature, and which in the end amount to complete metamorphosis? It is a new thing in the animal world, and separates man from the lower orders by an impassable gulf. The gulf has been crossed in the past; not by a sudden leap, but by slow growth and transmutation, just as the gulf between the bird and reptile, or between the reptile and the amphibian, has been crossed. Man is separated from the lower orders less by a phys-

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ical than by a psychological gulf. His anatomy is fundamentally the same, though there is doubtless an invisible gulf in the molecules of the brain cells; but his psychology is fundamentally different. Is this difference any greater, it may be asked, than that which separates the highest human intelligence from that of the lowest savage? I look upon it more as a difference of kind than of degree. It is comparatively easy to trace a continuous line of development from the mind of the Hottentot to the mind of the foremost European, but between the savage and our pithecoïd ancestors there are many missing links. The evolutionary process that must have connected them has worked out something like a metamorphosis.

Darwin in seeking to prove the animal origin of man felt called upon to show at least the rudiments of man's reasoning powers in his humbler beginnings. Certain it is that evolution must have something to go upon. But does it not have enough to go upon in the kind of intelligence the unthinking animal world exhibits? The slow metamorphosis of this into human reason is no more difficult to conceive of than a hundred other slow metamorphoses that may be traced in nature, wherein we see the adult animal totally unlike its youthful beginning, or where we see two chemical elements uniting to form a third entirely unlike either. Animal and vegetable life doubtless had a common

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origin, but behold how they have diverged. How could the intelligence of one have been evolved out of the intelligence of the other without this mystery of slow metamorphosis?

I do not know how far back along the line of evolution in animal life biologists place the beginning of the sense of sight, certainly the highest of all bodily senses. But it must have begun somewhere a good way this side of the first unicellular life; the eye as an organ and as we know it is doubtless a late development. And what a marvel it is! What can be a greater departure from the sense of touch and taste and smell — more like a miraculous addition or metamorphosis — than the sense of sight? And yet its foundation is the same as that of the other senses, nerve sensibility.

Or take another near-at-hand illustration. What can seem more like a new birth, a new creation, than the flower of a plant when contrasted with its leaves and stalk and root? Yet all this delicacy and color and fragrance come by way of these humbler parts; indeed, lay dormant there in the soil till this something we call life drew them out of it and built them up into this exquisite form. In the same way, may not the animal nature in the course of long ages have blossomed into the mental and spiritual powers which man possesses, and which are only latent in the lower creatures? We see the miracle of the flower daily, but the other miracle is

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a slow process that no man has witnessed or can witness. Strike out the element of time, and we see it as we see the stalk bring forth the flower, or as we see the grub metamorphosed into the butterfly.

We turn smoke into flame by supplying the fire with a little more oxygen. Has any new thing been added? What is added to transmute animal intelligence into human seems to be only more oxygen — more of that which favors mental combustion — more brain matter and a finer nervous organization.

III

We translate the action of bird and beast into human thought just as we translate their cries and calls into human speech. But the bird does not utter the words we ascribe to it, it only makes a sound that suggests the words. So its behavior is not the result of thought, but it is such as to suggest thought to a thinking animal, and we proceed to explain it in terms of thought.

We see a crow approaching a bit of meat upon the lawn in winter and note his suspicion. He circles about and surveys it from all points and approaches it with extreme caution, and we say he suspects some trap or concealed enemy, or plot to do him injury, when in fact he does not consciously suspect anything or think anything; he is simply obeying his inborn instinct to be on the lookout for danger at all times and in all places — the instinct

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of self-preservation. When the chickadee comes to the bone or bit of suet upon the tree under your window, it does so with little or no signs of suspicion. Its enemies are of a different kind, and its instincts work differently. Or when we see a fox trying to elude or delay the hound that is pursuing him, by taking to rail fences or bare plowed fields, or to the ice of frozen streams, we say he knows what he is doing; he knows his scent will not lie upon the rail or the bare earth or the ice as upon the snow or the moist ground. We translate his act into our mental concepts. The fox is, of course, trying to elude or to shake off his pursuer, but he is not drawing upon his stores of natural knowledge or his powers of thought to do so; he does not realize as you or I would that it is the scent of his foot that gives the clue to his enemy. How can he have any general ideas about odors and surfaces that best retain them? He is simply obeying the instinctive cunning of his vulpine nature, and takes to the fence or to the ice or to the water as a new expedient when others have failed. Such a course on our part under like circumstances would be the result of some sort of mental process, but with the fox it is evidence of the flexibility and resourcefulness of instinct. The animals all do rational things without reason, cunning things without calculation, and provident things without forethought. Of course we have to fall back upon

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instinct to account for their acts — that natural “propensity,” as Paley defined it, which is “prior to experience and independent of instruction.”

In both the animal and vegetable worlds we see a kind of intelligence that we are always tempted to describe in terms of our own intelligence; it seems to run parallel to and to foreshadow our own as to ways and means and getting on in the world — propagation, preservation, dissemination, adaptation — the plant resorting to many ingenious devices to scatter its seed and to secure cross-fertilization; the animal eluding its enemies, hiding its door or its nest, finding its way, securing its food, and many other things — all exhibiting a kind of intelligence that is independent of instruction or experience, and that suggests human reason without being one with it. Each knows what its kind knows, and each does what its kind does, but only in man do we reach self-knowledge and the freedom of conscious intelligence.

The animals all profit more or less by experience, and this would at first thought seem to imply some sort of mental capacity. But vegetables profit by experience also, and mainly in the same way, by increasing power to live and multiply. Hunt an animal and it becomes wary and hardy; persecute a plant and it, too, seems to tighten its hold upon life. How hardy and prolific are the weeds against which every man's hand is turned! How full of

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resources they are; how they manage to shift for themselves, while the cultivated plants are tender and helpless in comparison! Pull up redroot in your garden and lay it on the ground, and the chances are that one or more rootlets that come in contact with the soil will take hold again and enable the plant to mature part of its seeds. This adaptability and tenacity of life is, no doubt, the result of the warfare waged against this weed by long generations of gardeners. Natural selection steps in and preserves the most hardy. Of course the individual animal profits more by experience than the individual plant, yet the individual plant profits also. Do not repeated transplantings make a plant more hardy and increase its chances of surviving? If it does not learn something, it acquires new powers, it profits by adversity.

IV

But as the animal is nearer to us than the vegetable, so is animal intelligence nearer akin to our own than plant intelligence. We hear of plant physiology, but not yet of plant psychology. When a plant growing in a darkened room leans toward the light, the leaning, we are taught, is a purely mechanical process, the effect of the light upon the cells of the plant brings it about in a purely mechanical way; but when an animal is drawn to the light, the process is a much more complex one,

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and implies a nervous system. It is thought by some that the roots of a water-loving plant divine the water from afar and run toward it. The truth is, the plant or tree sends its roots in all directions, but those on the side of the water find the ground moister in that direction and their growth is accelerated, while the others are checked by the dryness of the soil. An ash tree stood on a rocky slope where the soil is thin and poor, twenty or twenty-five feet from my garden. After a while it sent so many roots down into the garden, and so robbed the garden vegetables of the fertilizers, that we cut the roots off and dug a trench to keep the tree from sending more. Now the gardener thought the tree divined the rich pasturage down below there and reached for it accordingly. The truth is, I suppose, that the roots on that side found a little more and better soil, and so pushed on till they reached the garden, where they were at once so well fed that they multiplied and extended themselves rapidly. Both plant and tree know a good thing when they find it. How could they continue if they did not?

A birch tree starting life upon the top of a rock, — as birch trees more than any others are wont to do, — where the soil is thin, soon starts a root down to the ground several feet below in what seems a very intelligent way. Now the tree cannot know that the ground is there within reach. On one side of the rock, usually on the north side, it finds

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moss and moisture, and here the root makes its way. When it reaches the edge of the rocks, it bends down just as a fluid would do and continues its course till it reaches the ground; then it rejoices, so to speak. All other roots are called in or dry up, this one root increases till it is like a continuation of the trunk itself, and a new root system is established in the ground. But why we find the birch more often established upon a rock than any other tree, I do not yet know.

I know of a little birch tree that is planted in the niche on the face of an almost perpendicular rock in the edge of the woods. There has been a tree, probably a birch, in the same niche before it, and in this mould of its ancestor the tree is planted. It has wedged its roots into the rock wherever there is a seam or crack, and it must have thriven fairly well on its scant rations of soil for several years, or until it became a sapling the size of one's wrist. Then it started a root diagonally down the face of the rock toward the ground, about four feet distant. How that root made its way there on that bare, smooth surface, where there is only a thin wash of lichens, is a mystery. But it did, and it reached the ground and is now the size of a broom handle, and is doubtless the tree's main source of sustenance.

What prompted the tree to send it down, to organize and equip this relief expedition to the soil

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across the desert face of the rock? I have always supposed a growing root lived off the country it traveled over, but in this case it must have been fed from the rear; the tree pushed it on even when it brought in no supplies. How interesting it would be to know how far this root would have traveled across that bare rock-face had the ground been many yards away! Have trees more wit than is dreamed of in our philosophy?

The intelligence of the plants and flowers of which Maeterlinck writes so delightfully is, of course, only a manifestation of the general intelligence that pervades all nature. Maeterlinck is usually sound upon his facts; however free and poetic he may be in the interpretation of them. The plants and flowers certainly do some wonderful things; they secure definite ends by definite means and devices, as much so as does man himself — witness the elaborate and ingenious mechanical contrivances by which the orchids secure cross-fertilization. Yet if we are to use terms strictly, we can hardly call it intelligence in the human sense, that is, the result of reflection on the part of the plant itself, any more than we can ascribe the general structure and economy of the plant, or of our own bodies, to an individual act of intelligence.

There are ten thousand curious and wonderful things in both the animal and vegetable worlds, and in the organic world as well, but it is only in a poetic

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and imaginative sense that we can speak of them as the result of intelligence on the part of the things themselves: we personify the things when we do so. The universe is pervaded with mind, or with something for which we have no other name. But it is not as an ingenious machine, say the modern printing-press, is pervaded with mind. The machine is a senseless tool in the hands of an external intelligence; in nature we see that the intelligence is within and is inseparable from it. The machine is the result of mind, but things in nature seem the organs of mind.

IX

THE REASONABLE BUT UNREASONING ANIMALS

I

THERE is to me a perennial interest in this question of animal instinct *versus* intelligence, and I trust my readers will pardon me if I again take the question up. Ever since one of our leading weekly journals (last June) declared its belief that "animals are capable of reasoning from certain premises, and do possess and express, though in a rudimentary form, many of the moral and intellectual processes and sentiments of man," I have wanted to take another shot at the subject. I do not now recall that any one has before claimed that the lower animals possess many of the moral sentiments of man, though a goodly number of persons seem to have persuaded themselves that animals do reason. Even so competent a naturalist as Mr. Hornaday says that asking if animals reason is to him like asking if fishes swim. But I suspect that Mr. Hornaday is a better naturalist than he is a comparative psychologist, because all the eminent comparative psychologists, so far as I know them,

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have reached the conclusion that animals do not reason. That eminent German psychologist, Wundt, says that the entire intellectual life of animals can be accounted for on the simple law of association; and Lloyd Morgan, the greatest of living English comparative psychologists, in his discussion of the question, "Do animals reason?" concludes that they do not — they do "not perceive the *why* and think the *therefore*." He urges, very justly, I think, that "in no case is an animal's activity to be interpreted as the outcome of a higher psychic faculty if it can fairly be interpreted as the outcome of faculties which are lower in the psychological scale." That is to say, Why impute reason to an animal if its behavior can be explained on the theory of instinct?

Some of our later nature writers seek to cut out instinct entirely, and call it all reason. If we cut out instinct, then we have two kinds of reason to account for and our last state is worse than our first. The young dog that in the house takes a bone and goes through the motions of burying it on the kitchen floor, digging the hole, putting it in, covering it up, and pressing the imaginary soil down with his nose, does not show the same kind of intelligence that even a child of four does when she puts her dolly in its little bed and carefully tucks it up. The one act is rational, the other is irrational; one is the result of observation, the other is inherited memory.

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There is much in a hasty view of animal life that looks like reason, because instinct is a kind of intelligence and it acts in a reasonable manner. But when we get something like an inside view of the mind of the lower orders, we see how fundamentally it differs from the human. And we get this view of it, not in the ordinary course of the animal's life, because the ordinary course of its life is appointed by its inherited instincts, but under exceptional conditions, when it encounters a new problem. Now, when a reasoning intelligence is confronted by a new problem, it recognizes it as such, and, having a fund of knowledge and experience to draw upon, it proceeds to deal with it accordingly. Not so the animal; it does not know the new problem when it sees it, and in its dealings with it acts much like a machine that was made to do some other work.

Let me group together here a number of instances from animal life, some of which I have given elsewhere in my writings, which show how much nearer the lower orders come to being mere automata than they come to being reasoning intelligences.

Take the case of the robin or bluebird that may often be seen in the spring, day after day, dashing itself madly against a window-pane, fighting its fancied rival there in its own reflected image, and never discovering that it is being fooled even after it has taken a peep into the empty room inside

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through a broken pane; or the case of the red squirrel that carried nuts all one day and put them into the end of a drain pipe that ran down an embankment wall and opened on to a pavement below, where the nuts behaved much as the water did that the pipe was meant to carry — they dropped down and rolled away across the street pavement. Or the case of the beaver that cut down a tree four times because the tree was held by the branches of other trees at the top so that it could not fall, but only dropped at each cutting the distance of the piece cut off. What finally decided the beaver to desist, it would be interesting to know. Or take the case of Hamerton's cow that in affection for her calf licked its stuffed skin till it ripped open and the hay with which it was stuffed fell out, when the bereaved mother proceeded to eat the hay with the utmost matter-of-course air.

During some long-gone time in the history of the raccoon it seems to have been needful for it to wash its food. Maybe the habit was acquired when it lived more exclusively than it does now upon fresh-water mussels, which it dug out of the mud along inland streams and lakes. At any rate, the coon now always washes its food, whether it needs washing or not, and in muddy water as promptly as in clear, so that the Germans call the coon the *Waschbär*. Ernest Harold Baynes tells me that he has taken young coons before their eyes were open, and

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brought them up on milk, and that the first time he gave them solid food, one of them took it and ran to a pail of water which it had never before seen, thrust the food into it, washed it, and then ate it. When no water was within reach, he has seen the coon rub the food a moment in its paws and then drop it. Dallas Lore Sharp says that his tame coon would go through the motions of washing its food on the upturned bottom of its empty tub, and that it would try to wash its oysters in the straw on the floor of its cage. This habit, I say, doubtless had its origin in some past need or condition of the life of the race of coons, and it persists after that need is gone.

The story that is told of the brakeman upon a train of cars in Russia, who at each stop of the train went from wheel to wheel, as was once the custom in all countries, and hit it a sharp blow with a hammer, saying on being asked why he did it, "I do not know, sir, it is my orders," illustrates very well the unreasoning character of animal instinct. The animal has its orders, but it does not think or ask why.

At Bahia Blanca, in South America, Darwin saw a bird, the casarita, that builds its nest in holes which it drills in the banks of streams like our kingfisher. At one place where he was stopping, the walls around the house were built of hardened mud, and were bored through and through with holes by these

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birds in their attempts to form their nests. The mud wall attracted them as if it had been a natural earth bank, and in trying to reach the proper depth for their nests, six feet or more, they invariably came through and out on the other side. Still they kept on drilling. Says Darwin:—

“I do not doubt that each bird, as often as it came to daylight on the opposite side, was greatly surprised at the marvelous fact.”

I do not suppose the bird really experienced any feeling of surprise at all, any more than the blue-bird above referred to did, when it looked into the vacant room and did not see the object of its wrath. The feeling of surprise comes to beings that understand the relation of cause and effect, which evidently the lower animals do not. Had the casarita been capable of the feeling of surprise, it would have been capable of seeing its own mistake.

Our high-hole is at times guilty of the same folly. When he drums on the metal ventilator or the tin leader upon your house, he has found a new thing, but it suits his purpose to make a noise to attract the attention of the female rather better than the dry stub did. And when he excavates a limb or tree-trunk for his nest, he acts like a reasonable being; but when he drills a hole through the clapboards of an empty building, and, not finding that the interior is what he wants, drills again and again, or perforates over and over the covering of an ice-house and

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lets out the sawdust, as I have often known him to do, what does he act like then?

Such instances reveal as by a flash of light the nature of animal mentality — how blindly, how automatically, the beasts act. If a person ever behaved in that way, we should say he had lost his mind, that reason was dethroned. We should not merely say he was unreasonable, we should say he was insane.

In its ordinary course of life the animal behaves in a reasonable manner, its course of action follows regular lines. Its progenitors have followed the same lines for countless generations; habit has worn a groove. But when a new, unheard-of condition confronts them, then there is no groove and their activity takes these irrational forms. When the phoebe-bird covers her nest in the ledge with moss, she does a reasonable thing; she blends it with the rock in a way that is both good art and good strategy. Now, if this were the result of reason, when she comes to the porch and to newly hewn timbers she would leave the moss off, because here it betrays rather than conceals her nest. But she sticks to her moss wherever she goes.

The same curious blundering may be seen in the insect world. For instance, the trap-door spiders in California make their nests in moss-covered ground and cover the lids of the doors with green growing moss. An English naturalist, as reported by Jordan

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and Kellogg in their "Animal Life," removed the moss and the other assimilative material from the door and found that the spider always replaced it. Then he removed it again, and with it the moss and débris from the ground in a large circle about the nest. This, of course, left the door as well concealed as before because it made it one with its surroundings. Did the spider leave it so? Not a bit of it. She fetched more moss and bits of bark and sticks and covered it as before, which gave away her secret completely. If she had done otherwise, or had covered her door with soil so as to make it one with its environment, we should have had to credit her with a faculty higher than instinct.

While speaking of insects in connection with this subject of the automatic character of animal intelligence, I am reminded of the habit of one of the solitary wasps as described by Fabre. When the wasp brings an insect to its hole, it lays it down at the entrance and backs down into the hole, apparently to make some examination, then comes out and drags in its prey. Fabre watched his opportunity, and, when the wasp had disappeared in her den, removed her game a few inches away. The wasp came out, hunted for her bug, found it and drew it back to its former position, then dropped it and retreated into her den as before. Fabre again drew the insect away, and again the wasp came out and repeated her former behavior. Time after

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time this little scene was enacted; the wasp *must* go into her den and make her preliminary survey before dragging in her prey. That habit had become fixed and there could be no deviation from it, and yet the wasps in many ways seem so surprisingly intelligent!

Another bee upon which Fabre experimented builds a cell of masonry, fills it with honey, lays her egg in it, and then seals it up. When the bee was away, Fabre punctured the half-filled cell and let the honey flow out. When the bee returned, she appeared to be disturbed to find her honey gone; she examined the hole through which it had escaped curiously, but made no attempt to repair it, and continued to pour in the honey the same as before. After she had brought the usual quantity -- the quantity her forbears had always brought -- she laid her egg in the empty cell and sealed it up. The machine had done its work, and it could do nothing not down in the ancestral specifications.

Dan Beard tells of an ichneumon-fly that tried all one day to thrust its ovipositor into a nail-head in a board in his cabin, mistaking the dark spot which the nail-head made for a hole that led to the burrow of a certain wood-borer which is the host of the ichneumon. Beard thinks the fly desisted only when it had seriously dulled the point of its instrument. I am reminded of one of our well-known wild flowers, the erythronium or fawn lily, that will persist in a

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certain habit, no matter how many times defeated. This plant forms a new bulb each spring by sending out a big tap-root, that bores down into the ground and plants the new bulb deeper and deeper each season till the required depth of six or eight inches is reached. When the ground is so hard that the pioneer root cannot penetrate it, it wanders in loops over the surface and forms the new bulb no deeper than the old one was, and keeps this habit up spring after spring, groping its way blindly about over the hard surface.

As further illustration of the automatic character of animal instinct, take the case of the migrating lemmings in Norway and Sweden. At times the country gets overstocked with these rodents, when vast numbers of them migrate down from the hills toward the sea, swimming the lakes and rivers in their way. This seems a reasonable course, and is very much what men would do under like circumstances; their instincts accord with reason. But mark what follows: when the lemmings reach the sea, they plunge in and swim till they perish. Having got in motion, they go on, like any other natural force, till they have spent themselves. It is said that steamships have at times encountered these bands of swimming rodents and been half an hour in steaming through them. I do not suppose they mistake the sea for another lake or river such as they have already crossed; I do not suppose any notions

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or comparisons exist in their minds about it. An impulse to migrate, which is like a decree of nature, has taken possession of them, and they obey it blindly, to their own destruction. These incidents, which recur at intervals, afford another illustration of how radically animal instinct differs from human reason. It is a kind of fate.

Instinct may be thwarted in its efforts, but it cannot be convinced that its effort is wrong, or has failed. One spring, as I have elsewhere related, a pair of English sparrows, in searching for a nesting-place, tried to effect an entrance into the interior of a horizontal timber upon my porch, through a large crack. Not being able to do this, they brought straws and weed stalks and filled up the crack from one end of the porch to the other, working at it day after day notwithstanding their rubbish was repeatedly swept away. It was nesting-time, the opening in the timber stimulated them, and they kept going as did the birds I have mentioned above. I do not suppose they had any knowledge that their efforts were futile; they only had the impulse to build, and of that impulse they did not know the purpose.

I have not cited the foregoing incidents to show the stupidity of bird or beast or insect — that were as great an error as to seek to prove their reasoning powers — but simply to illustrate the automatic character of animal behavior; to show that, if the lower orders are not mere automata, as Des Cartes

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long ago taught and as Huxley came to believe, adding only the qualifying adjective "conscious," making them "conscious automata," — then they come so near to it that it is difficult without exaggeration to credit them with any higher powers. At any rate, they reveal an order of mind that differs fundamentally from our own. Unless we are to abandon that comparison and classification which is the basis of all our knowledge, we must call it by another name — we must call it blind instinct. It does not see the why of anything which it does.

II

My dog and I are boon companions. I can live with him almost as with a brother, and yet I see him across a gulf. I catch a glimpse of that gulf, for example, when I see by his manner that he wants to lie down before the open fire, but, the poker or a stick of wood being in the way, instead of removing or pushing it to one side, as he could so easily do, he sits or half reclines there, and looks helplessly at the obstacle in his way. I get up and remove it and he lies down. The removal of that poker on his part would require a certain detachment and viewing of himself in relation to other things, of which he is not capable; and yet I know, had the obstacle barred the way to the retreat of a mouse or a chipmunk, he would have removed it in a hurry, because the scent of the

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game would have stimulated his instincts, or set up a reflex action, and put his paws in vigorous motion. He will, in an awkward kind of way, try to remove the burrs and bidens seeds from his coat, and bite at a sliver in his foot — these things irritate him and hence sustain a much closer relation to him than did the poker or the stick of wood; his instinct of self-defense is more or less aroused by them.

One's dog will come to cover when it rains, but can one think of him as putting on any cover to keep off the rain, or as bringing in his blanket out of the wet, unless especially trained? All such minor human acts are quite beyond the capacity of our wild or domestic animals, requiring as they do a certain self-detachment and viewing of things as they are in their relations.

Touch the spring of an animal's instinct or inherited habit, and it responds; but appeal to its power of independent thought, and it is, for the most part, as helpless as any other machine.

Birds will remove obstacles from their nests, and a setting hen will steal eggs from a nest within reach of her own. Such behavior shows only how acute and active their instincts are during the crisis of propagation.

The lower animals all seem to be upon the same plane; they are all yet at the breast of Nature, as it were, directly and unconsciously dependent upon her, while man has long since been weaned and

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separated from her. He has moved into another plane of being, still dependent, of course, upon the Nature of which he is, in a measure, the master. He still runs down into the region of reflex action, but he also runs up into the region of choice and reason and invention, where the animal does not follow him.

Man is emancipated, the animal is in bondage. And yet man surely came by the way of the lower animals. In these forms he tarried, these are his kith and kin; their marks are still upon him. But how he ever left them so far behind, who can tell? How did he cut loose from them? Why is my dog on one side of the gulf and I on the other? Why was he left behind by the impulse that brought me over? Why are we not either all dogs or all men? The wave has traveled, but the water has stayed behind. What started the wave? Where is the source of the force it represents? This man-impulse that has never been stayed, what or who started it? Through good and through evil report has it come, through slime and ooze, and reptile and fish, through monsters and dragons, and cat-
aclysm, and cosmic winters and summers, and has arrived safely at last with man on its crest.

Of course the animals show many human traits; their whole emotional life — and it is doubtful if they have any other — seems to run parallel to our own. They live in feeling, not in thought. Huxley says that this is because they have no language.

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They have no language because their brains are not developed to the language point. But to have emotions and feelings and associations and repulsions, the sense of direction, the sense of home, the love of offspring, the fear of enemies, we do not need a language, we need only the senses.

The animals show human traits every hour in the day, but my contention is that they do not show anything like human intelligence. The two pairs of orioles I saw one day come in collision as I was passing along the road behaved, I thought, in a very human way. Each couple had a nest in elm trees that stood near one another on the roadside, and were, of course, more or less jealous of each other's rights. As I was passing, the two females had come to blows in a clump of willows a few yards away and were having a lively scrap. Instantly the two males appeared, hurrying side by side to the scene of the squabble of their mates. Just what took place on their arrival I could not clearly make out, except that the females separated and the males came to blows. After sparring a moment or two, they alighted on the wire fence a few feet apart, where they eyed each other sharply and exchanged some very emphatic words, the purport of which I could only guess. How very human, I thought, that two husbands, in interfering in a quarrel between their wives, should get each other by the ears! My neighbor and I got

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into a "scrap" in trying to separate our dogs, exercising no more reason in the matter than did the orioles.

When Hobhouse, the English psychologist and philosopher, was trying to teach his elephant how to draw a bolt to open a box that contained a sweet morsel, the elephant used to lose its temper at times and bang the box around like a petulant child — a very human proceeding, I thought.

My son had a duck that one fall behaved, as it seemed to me, in quite a human way. He had a wild strain in him, and was brought up near the sea. He had lost his mate during the summer, and when fall came, I suppose the migrating instinct began to stir in him. He seemed uneasy and would leave the hens and wander off alone, softly calling as he walked. One night in early October he was missing, and we fancied a fox had snapped him up in the twilight. Days passed, till one evening one of the men saw a solitary duck flying past low over the buildings and fruit trees upon the lawn. He said it looked like our lost duck. A few days later the report came from our neighbor of a very tame wild duck upon the river. The duck had come ashore near his house, and he, not having a gun, had tried to capture it by a slip-noose at the end of a pole. But the duck took fright and flew away down the river. A day or two later it appeared again near our neighbor's house, and now,

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having learned that it was probably our lost duck, our neighbor set out to capture it by the use of corn, and finally succeeded. He then clipped one wing and turned it loose. The drake, failing in his efforts to fly, was a changed bird; disaster made him think of home, and the next day at twilight he turned his steps thitherward. He came slowly laboring up the hill, very silent and humble, and allowed himself to be picked up. It was hardly the return of a prodigal, but it was the coming back of a humbled and disappointed wanderer.

III

Animal conduct parallels human conduct in many particulars, but to say that it is the result of the same mental processes is, I believe, to make a capital mistake. Why, inorganic nature often seems to copy human methods, too, as, for instance, in a natural bridge. Behold on what sound mechanical principles the rude arch or span is built up! Shall we therefore ascribe the faculty of reason to the rocks? Or behold how the mountain-walls are buttressed, the overhanging cliff supported — it is all good engineering. In nature such things are the inevitable result of irrefragable mechanical laws; with the lower animals they are the result of instinct; with man they are the result of reason.

I notice that when the phœbe-bird builds her nest on the steep surface of a ledge, she begins like

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a true mechanic and widens her foundation gradually as she comes upward, till she has a shelf of mud wide enough to stand it on. It is all fit and well considered. We may think that the bird reasoned, and fail to see how inevitable all such things are in organic as well as in inorganic nature. The trees buttress themselves at their base by a circle of high curving roots, and how their branches are braced and reinforced where they leave the trunk!

The beaver building its dam seems like a reasonable being, and L. H. Morgan, who studied this animal in its native haunts in Wisconsin, and wrote the best monograph upon the subject that has ever appeared, thinks that it does reason; but one incident alone which he mentions shows by what unreasoning instinct the animal is guided. He saw where the beavers had built a dam by the trunk of a tree that had fallen across a stream, but instead of placing their sticks and brush against the upper side of the tree, so as to avail themselves of it in resisting the force of the current, they had placed them below it, so that the tree helped them not at all. Poor things! they encountered a new problem. They could build a dam, but they could not take advantage of the aid which the wind had offered them. Probably, had they felled the tree themselves, their instinct would not have blundered so in dealing with it.

As animals get along very well without hands

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and tools, so they get along very well without reason. Nature has given them tools in their organization in a sense that she has not given them to man — special appliances developed to meet special needs, such as hooks, spears, saws, files, chisels, barbs, drills, shears, probes, stings, drums, fiddles, cymbals, harps, glues, pastes, armors, stilts, pouches, all related to some need of the creature's life; and in the same way she has given them the quality of reason in their instincts. She has given the beaver knives and chisels in his teeth, she has given the woodpeckers drills in their beaks, she has given the leaf-cutters shears in their mandibles, she has given the bees baskets on their hips, she has given stilts to the waders and bills that are spears, to birds of prey claws that are hooks, and to various creatures weapons of offense and defense that man cannot boast of. Man has no tools or ornamental appendages in his organization, but he has that which can make and use these things — arms and hands, and reason to back them up. I can crack my nut with a stone or hammer, but the squirrel has teeth that help him to the kernel. Each of us is armed as best suits his needs. The mink and the otter can take their fish in the water, but I have to have a net, or a hook, or a weapon of some kind when I catch fish. The woodpecker can chisel out a hole in a tree for his nest or his house, with only the weapon nature gave him, but he cannot make a door to it, or patch it if it be-

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comes leaky. The trap-door spider can build a door to her den, because this instinct is one of her special equipments, and is necessary to her well-being. To the woodpecker such a door is not a necessity.

There are but few things we could teach the animals in their own proper sphere. We could give them hints when they are confronted by new problems, as in the case of the beaver above referred to, but in the ordinary course of nature these new problems rarely turn up. We could teach the beaver a little more system in the use of his material, but this would be of slight value to him; his dam, made very much as a flood makes a dam of driftwood and mud, answers his purpose. Could we teach the birds where to find a milder clime, or the dog how to find his way home, or the horse how to find water in the desert, or the muskrat or the beaver how to plan and construct houses better suited to their purposes? Could we teach the birds how better to hide their nests? Do the conies amid the rocks, that cure their hay before storing it up for winter use, need to take counsel of us? or the timid hare that sleeps with its eyes open, or the sluggish turtle that covers her eggs in the warm sand? Can we instruct the honey-bee in her own arts, or the ant in hers? The spider does not need to learn of us how to weave a net, nor the leaf-rolling insect to be taught the use of stitches. I do not know that we first learned the art of paper-making

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from the hornets, but certain it is that they hold the original patent for making paper from wood-pulp; and the little spiders navigated the air before the first balloon was made, and the *Physalia* hoisted her sail long before the first seaman spread his, and the ant-lion dug his pit and the carpenter-bee bored his hole long before man had learned these arts. Indeed, many of the arts and crafts of man exist or are foreshadowed in the world of life below him. There is no tool-user among the lower animals that I know of, unless we regard one of the solitary wasps as such when she uses a pebble with which to pack down the earth over her den; but there are many curious devices and makeshifts of one kind and another among both plants and animals for defense, for hiding, for scattering of seeds, for cross-fertilization, etc. The wild creatures have all been to school to an old and wise teacher, Dame Nature, who has been keeping school now, as near as we can calculate, for several million years. And she is not an indulgent teacher, though a very patient one. Her rod is tooth and claw and hunger and cold and drought and flood, and her penalty is usually death. Her ways are not all ways of pleasantness, nor are all her paths paths of peace.

When the animals are confronted by conditions made by man, then man can give them valuable hints. We could teach the cliff swallows better than to stick their mud nests on boards that have

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been planed and painted, because sooner or later they are sure to fall. We could teach the cunning crow not to be afraid of a string stretched across the cornfield, and the wary fox not to be barred from a setting fowl by a hoop of iron, and we could teach him to elude the hounds by taking to the highway and jumping into the hind end of a passing farm wagon on the way to the mill and curling up among the meal-bags, as Mr. Roberts's fox did. We could instruct the bird with broken legs how to make clay casts for them, and to give the clay a chance to harden, as the woodcock of Dr. Long did. The wild animals do not need our medicine because they are probably never ill, and only upon very rare occasions could our surgery be of use to them. The domestic animals sometimes need a midwife, but probably the wild creatures never do. They all learn slowly the things that it is necessary for them to know. In time, I have no doubt, the migrating birds will learn to avoid the lighthouses along the coast, where so many of them now meet their death.

Animals know what they have to know in order that the species may continue, and they know little else. They do not have to reason because they do not progress as man does. They have only to live and multiply, and for this their instincts suffice them. Neither do they require any of our moral sentiments. These would be a hindrance rather than a help, and, so far as I can see, they do not have them

X

THE GRIST OF THE GODS

ABOUT all we have in mind when we think of the earth is this thin pellicle of soil with which the granite framework of the globe is clothed — a red and brown film of pulverized and oxidized rock, scarcely thicker, relatively, than the paint or enamel which some women put on their cheeks, and which the rains often wash away as a tear washes off the paint and powder. But it is the main thing to us. Out of it we came and unto it we return. “Earth to earth, and dust to dust.” The dust becomes warm and animated for a little while, takes on form and color, stalks about recuperating itself from its parent dust underfoot, and then fades and is resolved into the original earth elements. We are built up out of the ground quite as literally as the trees are, but not quite so immediately. The vegetable is between us and the soil, but our dependence is none the less real. “As common as dust” is one of our sayings, but the common, the universal, is always our mainstay in this world. When we see the dust turned into fruit and flowers and grain by that intangible thing called vegetable life, or into the bodies of men and women by the equally mys-

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terious agency of animal life, we think better of it. The trembling gold of the pond-lily's heart, and its petals like carved snow, are no more a transformation of a little black muck and ooze by the chemistry of the sunbeam than our bodies and minds, too, are a transformation of the soil underfoot.

We are rooted to the air through our lungs and to the soil through our stomachs. We are walking trees and floating plants. The soil which in one form we spurn with our feet, and in another take into our mouths and into our blood — what a composite product it is! It is the grist out of which our bread of life is made, the grist which the mills of the gods, the slow patient gods of Erosion, have been so long grinding — grinding probably more millions of years than we have any idea of. The original stuff, the pulverized granite, was probably not very nourishing, but the fruitful hand of time has made it so. It is the kind of grist that improves with the keeping, and the more the meal-worms have worked in it, the better the bread. Indeed, until it has been eaten and digested by our faithful servitors the vegetables, it does not make the loaf that is our staff of life. The more death has gone into it, the more life comes out of it; the more it is a cemetery, the more it becomes a nursery; the more the rocks perish, the more the fields flourish.

This story of the soil appeals to the imagination.

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To have a bit of earth to plant, to hoe, to delve in, is a rare privilege. If one stops to consider, one cannot turn it with his spade without emotion. We look back with the mind's eye through the vista of geologic time and we see islands and continents of barren, jagged rocks, not a grain of soil anywhere. We look again and behold a world of rounded hills and fertile valleys and plains, depth of soil where before were frowning rocks. The hand of time with its potent fingers of heat, frost, cloud, and air has passed slowly over the scene, and the miracle is done. The rocks turn to herbage, the fetid gases to the breath of flowers. The mountain melts down into a harvest field; volcanic scoria changes into garden mould; where towered a cliff now basks a green slope; where the strata yawned now bubbles a fountain; where the earth trembled, verdure now undulates. Your lawn and your meadow are built up of the ruins of the foreworld. The leanness of granite and gneiss has become the fat of the land. What transformation and promotion! — the decrepitude of the hills becoming the strength of the plains, the decay of the heights resulting in the renewal of the valleys!

Many of our hills are but the stumps of mountains which the hand of time has cut down. Hence we may say that if God made the mountains, time made the hills.

What adds to the wonder of the earth's grist is

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that the millstones that did the work and are still doing it are the gentle forces that career above our heads — the sunbeam, the cloud, the air, the frost. The rain's gentle fall, the air's velvet touch, the sun's noiseless rays, the frost's exquisite crystals, these combined are the agents that crush the rocks and pulverize the mountains, and transform continents of sterile granite into a world of fertile soils. It is as if baby fingers did the work of giant powder and dynamite. Give the clouds and the sunbeams time enough, and the Alps and the Andes disappear before them, or are transformed into plains where corn may grow and cattle graze. The snow falls as softly as down and lies almost as lightly, yet the crags crumble beneath it; compacted by gravity, out of it grew the tremendous ice sheet that ground off the mountain summits, that scooped out lakes and valleys, and modeled our northern landscapes as the sculptor his clay image.

Not only are the mills of the gods grinding here, but the great cosmic mill in the sidereal heavens is grinding also, and some of its dust reaches our planet. Cosmic dust is apparently falling on the earth at all times. It is found in the heart of hailstones and in Alpine snows, and helps make up the mud of the ocean floors.

During the unthinkable time of the revolution of the earth around the sun, the amount of cosmic

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matter that has fallen upon its surface from out the depths of space must be enormous. It certainly must enter largely into the composition of the soil and of the sedimentary rocks. Celestial dirt we may truly call it, star dust, in which we plant our potatoes and grain and out of which Adam was made, and every son of man since Adam — the divine soil in very fact, the garden of the Eternal, contributed to by the heavens above and all the vital forces below, incorruptible, forever purifying itself, clothing the rocky framework of the globe as with flesh and blood, making the earth truly a mother with a teeming fruitful womb, and her hills veritable mammary glands. The iron in the fruit and vegetables we eat, which thence goes into our blood, may, not very long ago, have formed a part of the cosmic dust that drifted for untold ages along the highways of planets and suns.

The soil underfoot, or that we turn with our plow, how it thrills with life or the potencies of life! What a fresh, good odor it exhales when we turn it with our spade or plow in spring! It is good. No wonder children and horses like to eat it!

How inert and dead it looks, yet what silent, potent fermentations are going on there — millions and trillions of minute organisms ready to further your scheme of agriculture or horticulture. Plant your wheat or your corn in it, and behold the miracle of a birth of a plant or a tree. How it pushes

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up, fed and stimulated by the soil, through the agency of heat and moisture! It makes visible to the eye the life that is latent or held in suspense there in the cool, impassive ground. The acorn, the chestnut, the maple keys, have but to lie on the surface of the moist earth to feel its power and send down rootlets to meet it.

From one point of view, what a ruin the globe is! — worn and crumbled and effaced beyond recognition, had we known it in its youth. Where once towered mountains are now only their stumps — low, fertile hills or plains. Shake down your great city with its skyscrapers till most of its buildings are heaps of ruins with grass and herbage growing upon them, and you have a hint of what has happened to the earth.

Again, one cannot but reflect what a sucked orange the earth will be in the course of a few more centuries. Our civilization is terribly expensive to all its natural resources; one hundred years of modern life doubtless exhausts its stores more than a millennium of the life of antiquity. Its coal and oil will be about used up, all its mineral wealth greatly depleted, the fertility of its soil will have been washed into the sea through the drainage of its cities, its wild game will be nearly extinct, its primitive forests gone, and soon how nearly bankrupt the planet will be!

There is no better illustration of the way decay

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and death play into the hands of life than the soil underfoot. The earth dies daily and has done so through countless ages. But life and youth spring forever from its decay; indeed, could not spring at all till the decay began. All the soil was once rock, perhaps many times rock, as the water that flows by may have been many times ice.

The soft, slow, aerial forces, how long and patiently they have worked! Oxygen has played its part in the way of oxidation and dioxidation of minerals. Carbon or carbonic acid has played its part, hydrogen has played its. Even granite yields slowly but surely to the action of rain-water. The sun is of course the great dynamo that runs the earth machinery and, through moisture and the air currents, reduces the rocks to soil. Without solar heat we should have no rain, and without rain we should have no soil. The decay of a mountain makes a hill of fertile fields. The soil, as we know it, is the product of three great processes — mechanical, chemical, and vital — which have been going on for untold ages. The mechanical we see in the friction of winds and waves and the grinding of glaciers, and in the destructive effects of heat and cold upon the rocks; the chemical in the solvent power of rain-water and of water charged with various acids and gases. The soil is rarely the color of the underlying rock from which it came, by reason of the action of the various gases of the atmosphere. Iron

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is black, but when turned into rust by the oxygen of the air, it is red.

The vital processes that have contributed to the soil we see going on about us in the decay of animal and vegetable matter. It is this process that gives the humus to the soil, in fact, almost humanizes it, making it tender and full of sentiment and memories, as it were, so that it responds more quickly to our needs and to our culture. The elements of the soil remember all those forms of animal and vegetable life of which they once made a part, and they take them on again the more readily. Hence the quick action of wood ashes upon vegetable life. Iron and lime and phosphorus that have once been taken up by growing plants and trees seem to have acquired new properties, and are the more readily taken up again.

The soil, like mankind, profits by experience, and grows deep and mellow with age. Turn up the cruder subsoil to the sun and air and to vegetable life, and after a time its character is changed; it becomes more gentle and kindly and more fertile.

All things are alike or under the same laws — the rocks, the soil, the soul of man, the trees in the forest, the stars in the sky. We have fertility, depth, geniality, in the ground underfoot, on the same terms upon which we have these things in human life and character.

We hardly realize how life itself has stored up

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life in the soil, how the organic has wedded and blended with the inorganic in the ground we walk upon. Many if not all of the sedimentary rocks that were laid down in the abysses of the old ocean, out of which our soil has been produced, and that are being laid down now, out of which future soils will be produced, were and are largely of organic origin, the leavings of untold myriads of minute marine animals that lived millions of years ago. Our limestone rocks, thousands of feet thick in places, the decomposition of which furnishes some of our most fertile soils, are mainly of plant and animal origin. The chalk hills of England, so smooth and plump, so domestic and mutton-suggesting, as Huxley says, are the leavings of minute creatures called *Globigerinæ*, that lived and died in the ancient seas in the remote past. Other similar creatures, *Radiolaria* and diatoms, have played an equally important part in contributing the foundation of our soils. Diatom earth is found in places in Virginia forty feet thick. The coral insects have also contributed their share to the soil-making rocks. Our marl-beds, our phosphatic and carbonaceous rocks, are all largely of animal origin. So that much of our soil has lived and died many times, and has been charged more and more during the geologic ages or eternities with the potencies of life.

Indeed, Huxley, after examining the discoveries of the *Challenger* expedition, says there are good

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grounds for the belief "that all the chief known constituents of the crust of the earth may have formed part of living bodies; that they may be the 'ash' of protoplasm."

This implies that life first appeared in the sea, and gave rise to untold myriads of minute organisms, that built themselves shells out of the mineral matter held in solution by the water. As these organisms perished, their shells fell to the bottom and formed the sedimentary rocks. In the course of ages these rocks were lifted up above the sea, and their decay and disintegration under the action of the elements formed our soil — our clays, our marls, our green sand — and out of this soil man himself is built up.

I do not wonder that the Creator found the dust of the earth the right stuff to make Adam of. It was half man already. I can easily believe that his spirit was evoked from the same stuff, that it was latent there, and in due time, under the brooding warmth of the creative energy, awoke to life.

If matter is eternal, as science leads us to believe, and creation and recreation a never-ending process, then the present world, with all its myriad forms of the organic and the inorganic, is only one of the infinite number of forms that matter must have assumed in past æons. The whole substance of the globe must have gone to the making of other globes such a number of times as no array of fig-

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ures could express. Every one of the sixty or more primary elements that make up our own bodies and the solid earth beneath us must have played the same part in the drama of life and death, growth and decay, organic and inorganic, that it is playing now, and will continue to play through an unending future.

This gross matter seems ever ready to vanish into the transcendental. When the new physics is done with it, what is there left but spirit, or something akin to it? When the physicist has followed matter through all its transformations, its final disguise seems to be electricity. The solid earth is resolvable into electricity, which comes as near to spirit as anything we can find in the universe.

Our senses are too dull and coarse to apprehend the subtle and incessant play of forces about us — the finer play and emanations of matter that go on all about us and through us. From a lighted candle, or gas-jet, or glowing metal shoot corpuscles or electrons, the basic constituents of matter, of inconceivable smallness — a thousand times smaller than an atom of hydrogen — and at the inconceivable speed of 10,000 to 90,000 miles a second. Think how we are bombarded by these bullets as we sit around the lamp or under the gas-jet at night, and are all unconscious of them! We are immersed in a sea of forces and potentialities of which we hardly dream. Of the scale of temperatures, from absolute

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zero to the heat of the sun, human life knows only a minute fraction. So of the elemental play of forces about us and over us, terrestrial and celestial — too fine for our apprehension on the one hand, and too large on the other — we know but a fraction.

The quivering and the throbbing of the earth under our feet in changes of temperature, the bendings and oscillations of the crust under the tread of the great atmospheric waves, the vital fermentations and oxidations in the soil — are all beyond the reach of our dull senses. We hear the wind in the treetops, but we do not hear the humming of the sap in the trees. We feel the pull of gravity, but we do not feel the medium through which it works. During the solar storms and disturbances all our magnetic and electrical instruments are agitated, but you and I are all unconscious of the agitation.

There are no doubt vibrations from out the depths of space that might reach our ears as sound were they attuned to the ether as the eye is when it receives a ray of light. We might hear the rush of the planets along their orbits, we might hear the explosions and uprushes in the sun; we might hear the wild whirl and dance of the nebulae, where suns and systems are being formed; we might hear the “wreck of matter and the crush of worlds” that evidently takes place now and then in the abysses of space, because all these things must send through the ether impulses and tremblings that reach our

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planet. But if we felt or heard or saw or were conscious of all that was going on in the universe, what a state of agitation we should be in! Our scale of apprehension is wisely limited, mainly to things that concern our well-being.

But let not care and humdrum deaden us to the wonders and the mysteries amid which we live, nor to the splendors and the glories. We need not translate ourselves in imagination to some other sphere or state of being to find the marvelous, the divine, the transcendent; we need not postpone our day of wonder and appreciation to some future time and condition. The true inwardness of this gross visible world, hanging like an apple on the bough of the great cosmic tree, and swelling with all the juices and potencies of life, transcends anything we have dreamed of super-terrestrial abodes. It is because of these things, because of the vitality, spirituality, oneness, and immanence of the universe as revealed by science, its condition of transcending time and space, without youth and without age, neither beginning nor ending, neither material nor spiritual, but forever passing from one into the other, that I was early and deeply impressed by Walt Whitman's lines:—

“There was never any more inception than there is now,
Nor any more youth or age than there is now;
And will never be any more perfection than there is now,
Nor any more heaven or hell than there is now.”

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And I may add, nor any more creation than there is now, nor any more miracles, or glories, or wonders, or immortality, or judgment days, than there are now. And we shall never be nearer God and spiritual and transcendent things than we are now. The babe in its mother's womb is not nearer its mother than we are to the invisible sustaining and mothering powers of the universe, and to its spiritual entities, every moment of our lives.

The doors and windows of the universe are all open; the screens are all transparent. We are not barred or shut off; there is nothing foreign or unlike; we find our own in the stars as in the ground underfoot; this clod may become a man; yon shooting star may help redden his blood.

Whatever is upon the earth is of the earth; it came out of the divine soil, beamed upon by the fructifying heavens, the soul of man not less than his body.

I never see the spring flowers rising from the mould, or the pond-lilies born of the black ooze, that matter does not become transparent and reveal to me the working of the same celestial powers that fashioned the first man from the common dust.

Man's mind is no more a stranger to the earth than is his body. Is not the clod wise? Is not the chemistry underfoot intelligent? Do not the roots of the trees find their way? Do not the birds know

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their times and seasons? Are not all things about us filled to overflowing with mind-stuff? The cosmic mind is the earth mind, and the earth mind is man's mind, freed but narrowed, with vision but with erring reason, conscious but troubled, and — shall we say? — human but immortal.

XI

THE DIVINE SOIL

I

HOW few persons can be convinced of the truth of that which is repugnant to their feelings! When Darwin published his conclusion that man was descended from an apelike ancestor who was again descended from a still lower type, most people were shocked by the thought; it was intensely repugnant to their feelings. Carlyle, for instance, treated the proposition with contempt. He called it the "gospel of dirt." "A good sort of man," he said, "is this Darwin, and well meaning, but with very little intellect." Huxley tells of seeing the old man one day upon the street, and of crossing over to greet him. Carlyle looked up and said, "You're Huxley, are n't you? the man who says we are all descended from monkeys," and went on his way. It would be interesting to know just what Carlyle thought we were descended from. Could he, or did he, doubt at all that if he were to go back a few thousand years over his own line of descent, he would come upon rude savage men, who used stone implements, and lived in caves or rude huts, who had neither letters nor arts, and with whom might did indeed make right, and that back of these he would find

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still more primitive races, and that these too had their still more savage and bestial forbears? When started on the back track of his own race, where could he stop? Could he stop anywhere? The neolithic man stands on the shoulders of the paleolithic, and he on a still lower human or semi-human form, till we come to a manlike ape or an apelike man, living in trees and subsisting on roots and nuts and wild fruits. Every child born to-day, by the grip of its hands, the strength of its arms, and the weakness of its legs, hints of those far-off arboreal ancestors. Carlyle must also have known that in his fetal or prenatal life there was a time when his embryo could not have been distinguished from that of a dog, to say nothing of a monkey. Was this fact also intolerable to him?

It must be a bitter pill to persons of Carlyle's temperament to have to accept the account of their own human origin; that the stork legend of the baby is, after all, not good natural history. The humble beginning of each of us is not one that appeals to the imagination, nor to the religious sentiment, nor to our love of the mysterious and the remote, yet the evidence in favor of its truth is pretty strong.

In fact, the Darwinian theory of the origin of man differs from the popular one just as the natural history of babies as we all know it differs from the account in the nursery legends, and gives about

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the same shock to our sensibilities and our pride of origin.

One of the hardest lessons we have to learn in this life, and one that many persons never learn, is to see the divine, the celestial, the pure, in the common, the near at hand — to see that heaven lies about us here in this world. Carlyle's gospel of dirt, when examined closely, differs in no respect from a gospel of star dust. Why, we have invented the whole machinery of the supernatural, with its unseen spirits and powers good and bad, to account for things, because we found the universal everyday nature too cheap, too common, too vulgar. We have had to cap the natural with the supernatural to satisfy our love for the marvelous and the inexplicable. As soon as a thing is brought within our ken and the region of our experience, it seems to lose caste and be cheapened. I am at a loss how to account for this mythopoetic tendency of ours, but what a part it has played in the history of mankind, and what a part it still plays — turning the light of day into a mysterious illusive and haunted twilight on every hand! It would seem as if it must have served some good purpose in the development of the race, but just what is not so easy to point out as the evil it has wrought, the mistakes and self-delusions it has given rise to. One may probably say that in its healthy and legitimate action it has given rise to poetry and to art and to the many

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escapes which the imagination provides us from the hard and wearing realities of life. Its implacable foe is undoubtedly the scientific spirit — the spirit of the now and the here, that seeks proof and finds the marvelous and the divine in the ground underfoot; the spirit that animated Lyell and opened his eyes to the fact that the forces and agencies at work every day around us were adequate to account for the tremendous changes in the earth's surface in the past; that animated Darwin and led him to trace the footsteps of the creative energy in the natural life of plants and animals to-day; that animated Huxley and filled him with such righteous wrath at the credulity of his theological brethren; and that animates every one of us when we clinch a nail, or stop a leak, or turn a thing over and look on the other side, and apply to practical affairs the touchstone of common sense.

That man is of divine origin in a sense that no other animal is, is a conviction dear to the common mind. It was dear to the mind of Carlyle, it chimed in well with his distrust of the present, his veneration of the past, and his Hebraic awe and reverential fear before the mysteries of the universe. While Darwin's attitude of mind toward outward things was one of inquiry and thirst for exact knowledge, Carlyle's was one of reverence and wonder. He was more inclined to worship where Darwin was moved to investigate. Darwin, too, felt the

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presence of the great unknown, but he sought solace in the knowable of the physical world about him, while Carlyle sought solace in the moral and intellectual world, where his great mythopoetic faculty could have free swing.

We teach and we preach that God is in everything from the lowest to the highest, and that all things are possible with him, and yet practically we deny that he is in the brute, and that it is possible man should have had his origin there.

I long ago convinced myself that whatever is on the earth and shares its life is of the earth, and, in some way not open to me, came out of the earth, the highest not less than the humblest creature at our feet. I like to think of the old weather-worn globe as the mother of us all. I like to think of the ground underfoot as plastic and responsive to the creative energy, vitally related to the great cosmic forces, a red corpuscle in the life current of the Eternal, and that man, with all his high-flying dreams and aspirations, his arts, his bibles, his religions, his literatures, his philosophies — heroes, saints, martyrs, sages, poets, prophets — all lay folded there in the fiery mist out of which the planet came. I love to make Whitman's great lines my own: —

"I am an acme of things accomplished, and I an endorser of things to be.

My feet strike an apex of the apices of the stairs,

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On every step bunches of ages, and larger bunches between
the steps,
All below duly traveled, and still I mount and mount.

“ Rise after rise bow the phantoms behind me,
Afar down I see the huge first Nothing — I know I was even
there,
I waited unseen and always, and slept through the lethargic
mist,
And took my time, and took no hurt from the fetid carbon.

“ Long I was hugged close — long and long.
Immense have been the preparations for me,
Faithful and friendly the arms that have helped me.
Cycles ferried my cradle, rowing and rowing like cheerful boat-
men,
For room to me stars kept aside in their own rings,
They sent influences to look after what was to hold me.

“ Before I was born out of my mother generations guided me,
My embryo has never been torpid — nothing could overlay it.
For it the nebula cohered to an orb,
The long, slow strata piled to rest it in,
Vast vegetables gave it sustenance,
Monstrous sauroids transported it in their mouths and depos-
ited it with care.
All forces have been steadily employed to complete and delight
me,
Now I stand on this spot with my Soul.”

II

The material, the carnal, the earthy, has been so
long under the ban, so long associated in our minds
with that which hinders and degrades, and as the
source and province of evil, that it will take sci-

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ence a long time to redeem it and lift it again to its proper place.

It jars upon our sensibilities and disturbs our preconceived notions to be told that the spiritual has its root in the carnal, and is as truly its product as the flower is the product of the roots and the stalk of the plant. The conception does not cheapen or degrade the spiritual, it elevates the carnal, the material. To regard the soul and body as one, or to ascribe to consciousness a physiological origin, is not detracting from its divinity, it is rather conferring divinity upon the body. One thing is inevitably linked with another — the higher forms with the lower forms, the butterfly with the grub, the flower with the root, the food we eat with the thought we think, the poem we write, or the picture we paint, with the processes of digestion and nutrition. How science has enlarged and ennobled and purified our conception of the universe; how it has cleaned out the evil spirits that have so long terrified mankind, and justified the verdict of the Creator: "and behold it was good"! With its indestructibility of matter, its conservation of energy, its inviolability of cause and effect, its unity of force and elements throughout sidereal space, it has prepared the way for a conception of man, his origin, his development, and in a measure his destiny, that at last makes him at home in the universe.

How much more consistent it is with what we

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know of the unity of nature to believe that one species should have come through another, that man should have come through the brute rather than have been grafted upon him from without. Unfolding and ever unfolding, upward and onward, from the lower to the higher, from the simple to the complex — that has been the course of organic evolution from the first.

One thinks of the creative energy as working along many lines, only one of which eventuated in man; all the others fell short, or terminated in lower forms. Hence while we think of man as capable of, and destined to, still higher development, we look upon the lower orders as having reached the end of their course, and conclude there is no to-morrow for them.

The anthropoid apes seem indeed like preliminary studies of man, or rejected models of the great inventor who was blindly groping his way to the higher form. The ape is probably our ancestor in no other sense than this. Nature seems to have had man in mind when she made him, but evidently she lost interest in him, humanly speaking, and tried some other combination. The ape must always remain an ape. Some collateral branch doubtless gave birth to a higher form, and this to a still higher, till we reach our preglacial forbears. Then some one branch or branches distanced all others, leaving rude tribes by the way in whom

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development seemed arrested, till we reach the dawn of history.

The creative energy seems ever to have been pushing out and on, and yet ever leaving a residue of forms behind. The reptiles did not all become birds, nor the invertebrates all become vertebrates, nor the apes all become men, nor the men all become Europeans. Every higher form has a base or background of kindred lower forms out of which it seems to have emerged, and to which it now and then shows a tendency to revert. And this is the order of nature everywhere, in our own physiology and psychology not less than in the evolution of the forms of life. Do not our highest ideals have their rise and foundation in sensation and experience? There is no higher without first the lower, and the lower does not all become the higher.

The blood relationship between man and the anthropoid apes, as shown in the fact that human blood acts poisonously upon and decomposes the blood of the lower apes and other mammals, but is harmless to the blood of the anthropoid apes and affiliates with it, is very significant. It convinces like a demonstration. Transfer the blood of the dog to the fox or the wolf, or *vice versa*, and all goes well; they are brothers. Transfer the blood of the dog to the rabbit, or *vice versa*, and a struggle for life immediately takes place. The serum of one

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blood destroys the cells of the other. This fact confirms Huxley's statement that the anatomical difference between man and the anthropoid apes is less than the corresponding difference between the latter and the lower apes.

III

One thing we may affirm about the universe — it is logical; the conclusion always follows from the premises.

The lesson which life repeats and constantly enforces is "look under foot." You are always nearer the divine and the true sources of your power than you think. The lure of the distant and the difficult is deceptive. The great opportunity is where you are. Do not despise your own place and hour. Every place is under the stars, every place is the centre of the world. Stand in your own doorway and you have eight thousand miles of solid ground beneath you, and all the sidereal splendors overhead. The morning and the evening stars are no more in the heavens and no more obedient to the celestial impulses than the lonely and time-scarred world we inhabit. How the planet thrills and responds to the heavenly forces and occurrences we little know, but we get an inkling of it when we see the magnetic needle instantly affected by solar disturbances.

Look under foot. Gold and diamonds and all

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precious stones come out of the ground; they do not drop upon us from the stars, and our highest thoughts are in some way a transformation or a transmutation of the food we eat. The mean is the divine if we make it so. The child surely learns that its father and mother are the Santa Claus that brought the gifts, though the discovery may bring pain; and the man learns to see providence in the great universal forces of nature, in the winds and the rain, in the soil underfoot and in the cloud overhead. What these forces in their orderly rounds do not bring him, he does not expect. The farmer hangs up his stocking in the way of empty bins and barns, and he knows well who or what must fill them. The Santa Claus of the merchant, the manufacturer, the inventor, is the forces and conditions all about us in every-day operation. When the lightning strikes your building or the trees on your lawn, you are at least reminded that you do not live in a corner outside of Jove's dominions, you are in the circuit of the great forces. If you are eligible to bad fortune where you stand, you are equally eligible to good fortune there. The young man who went West did well, but the young man who had the Western spirit and stayed at home did equally well. To evoke a spark of fire out of a flint with a bit of steel is the same thing as evoking beautiful thoughts from homely facts. How hard it is for us to see the heroic in an act of our neighbor!

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IV

What a burden science took upon itself when it sought to explain the origin of man! Religion or theology takes a short cut and makes quick work of it by regarding man as the result of the special creative act of a supernatural Being. But science takes a long and tedious and hazardous way around through the lowest primordial forms of life. It seeks to trace his germ through the abyss of geologic time, where all is dim and mysterious, through countless cycles of waiting and preparation, where the slow, patient gods of evolution cherished it and passed it on, through the fetid carbon, through the birth and decay of continents, through countless interchanges and readjustments of sea and land, through the clash and warring of the cosmic forces, through good and evil report, through the fish and the reptile, through the ape and the orang, up to man — from the slime at the bottom of the primordial ocean up to Jesus of Nazareth. Surely one may say with Whitman, —

“Immense have been the preparations for me,
Faithful and friendly the arms that have helped me.”

It took about one hundred thousand feet of sedimentary rock, laid down through hundreds of millions of years in the bottom of the old seas, all probably the leavings of minute forms of life, to make a foundation upon which man could appear.

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His origin as revealed by science fills and appalls the imagination: as revealed by theology it simply baffles and dumfounds one. Science deepens the mystery while yet it gives the reason and the imagination something to go upon; it takes us beyond soundings, but not beyond the assurance that cause and effect are still continuous there beneath us. I like to think that man has traveled that long, adventurous road, that the whole creation has pulled together to produce him. It is a road, of course, beset with pain and anguish, beset with ugly and repellent forms, beset with riot and slaughter; it leads through jungle and morass, through floods and cataclysms, through the hells of the Mesozoic and the Cenozoic periods, but it leads ever upward and onward.

The manward impulse in creation has doubtless been checked many times, but never lost; all forms conspired to further it, and it seemed to have taken the push and the aspiration out of each order as it passed on, dooming it henceforth to a round of life without change or hope of progress, leaving the fish to continue fish, the reptiles to continue reptiles, the apes to continue apes; it took all the heart and soul of each to feed and continue the central impulse that was to eventuate in man.

I fail to see why our religious brethren cannot find in this history or revelation as much room for creative energy, as large a factor of the mysterious and

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superhuman, as in the myth of Genesis. True it is that it fixes our attention upon this world and upon forces with which we are more or less familiar, but it implies an element or a power before which we stand helpless and dumb. What fathered this man-impulse, what launched this evolutionary process, what or who stamped upon the first protoplasm the aspiration to be man, and never let that aspiration sleep through all the tremendous changes of those incalculable geologic ages? What or who first planted the seed of the great biological tree, and determined all its branchings and the fruit it should bear? If you must have a God, either apart from or imminent in creation, it seems to me that there is as much need of one here as in the Mosaic cosmology. The final mystery cannot be cleared up. We can only drive it to cover. How the universe came to be what it is, and how man came to be man, who can tell us?

That somewhere in my line of descent was an ancestor that lived in trees and had powerful arms and weaker legs, that his line began in a creature that lived on the ground, and his in one that lived in the mud, or in the sea, and his, or its, sprang from a germ at the bottom of the sea, but deepens the mystery of the being that is now here and can look back and speculate over the course he has probably come; it only directs attention to ugly facts, to material things, to the every-day process

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of evolution, instead of to the far away, the unknown, or the supernatural.

How the organic came to bud and grow from the inorganic, who knows? Yet it must have done so. We seem compelled to think of an ascending series from nebular matter up to the spirituality of man, each stage in the series resting upon or growing out of the one beneath it. Creation or development must be continuous. There are and can be no breaks. The inorganic is already endowed with chemical and molecular life. The whole universe is alive, and vibrates with impulses too fine for our dull senses; but in chemical affinity, in crystallization, in the persistence of force, in electricity, we catch glimpses of a kind of vitality that is preliminary to all other. I never see fire burn, or water flow, or the frost-mark on the pane, that I am not reminded of something as mysterious as life. How alive the flame seems, how alive the water, how marvelous the arborescent etchings of the frost! Is there a principle of fire? Is there a principle of crystallization? Just as much as there is a principle of life. The mind, in each case, seems to require something to lay hold of as a cause. Why these wonderful star forms of the snowflake? Why these exact geometric forms of quartz crystals? The gulf between disorganized matter and the crystal seems to me as great as that between the organic and the inor-

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ganic. If we did not every day witness the passage, we could not believe it. The gulf between the crystal and the cell we have not seen cleared, and man has not yet been able to bridge it, and may never be, but it has been bridged, and I dare say without any more miracle than hourly goes on around us. The production of water from two invisible gases is a miracle to me. When water appeared (what made it appear?) and the first cloud floated across the blue sky, life was not far off, if it was not already there. Some morning in spring when the sun shone across the old Azoic hills, at some point where the land and sea met, life began — the first speck of protoplasm appeared. Call it the result of the throb or push of the creative energy that pervades all things, and whose action is continuous and not intermittent, since we are compelled to presuppose such energy to account for anything, even our own efforts to account for things. An ever active vital force pervades the universe, and is felt and seen in all things, from atomic attraction and repulsion up to wheeling suns and systems. The very processes of thought seem to require such premises to go upon. There is a reason for the universe as we find it, else man's reason is a delusion, and delusion itself is a meaningless term. The uncaused is unthinkable; thought can find neither beginning nor ending to the universe because it cannot find the primal cause. Can

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we think of a stick with only one end? We have to if we compass time in thought, or space, either.

v

Given atomic motion, chemical affinity — this hunger or love of the elements for one another — crystallization, electricity, radium, the raining upon us of solar and sidereal influences, the youth of the earth, and the whole universe vibrating with the cosmic creative energy, the beginning of life, the step from the inorganic to the organic, is not so hard to conceive. In a dead universe this would be hard, but we have a universe throbbing with cosmic life and passion to begin with. It is impossible for me to think of anything as uncaused, and in trying to figure to myself this beginning of life I have to postulate this universal creative energy that pervades the worlds as animating the atoms and causing them to combine so as to produce the primordial protoplasm. Then when the first cell divides and becomes two, I have to think of an inherent something that prompts the act, and so on all the way up.

I cannot conceive of crystallization, this precise and invariable arrangement of certain elements, nor of the invariable chemical compounds, without postulating some inner force, or will, or tendency that determines them. I cannot conceive of an atom of carbon, or oxygen, or hydrogen as doing anything of itself. It must be alive, and this life

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and purpose pervades the universe. This inability on my part may be only the limitation of thought. I know there are things I cannot conceive of that are yet true. I cannot conceive how the sky is still overhead at the South Pole as at the North, because one position to my senses is the reverse of the other, and I am compelled to think of up and down as the same. I cannot think how anything can begin, because time, like matter, is infinitely divisible, and there always remains a mathematical fragment of time between the not beginning and the beginning. The conditions of thought are such that I do not see how one can think of one's self, that is, be object and subject at the same instant of time — jump down one's own throat, so to speak — and yet we seem to manage to do it.

VI

If life can finally be explained in terms of physics and chemistry, that is, if the beginning of life upon the globe was no new thing, the introduction of no new principle, but only the result of a vastly more complex and intimate play and interaction of the old physico-chemical forces of the inorganic world, then the gulf that is supposed to separate the two worlds of living and non-living matter virtually disappears: the two worlds meet and fuse. We shall probably in time have to come to accept this view — the view of the mechanico-chemical theory of life.

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It is in a line with the whole revelation of science, so far — the getting rid of the miraculous, the unknowable, the transcendental, and the enhancing of the potency and the mystery of things near at hand that we have always known in other forms. It is at first an unpalatable truth, like the discovery of the animal origin of man, or that consciousness and all our fine thoughts and aspirations are the result of molecular action in the brain; or like the experience of the child when it discovers that its father or mother is the Santa Claus that filled its stockings. Science is constantly bringing us back to earth and to the ground underfoot. Our dream of something far off, supernatural, vanishes. We lose the God of a far-off heaven, and find a God in the common, the near, always present, always active, always creating the world anew. Science thus corrects our delusions and vague superstitions, and brings us back near home for the key we had sought afar. We shall probably be brought, sooner or later, to accept another unpalatable theory, that of the physical origin of the soul, that it is not of celestial birth except as the celestial and terrestrial are one. This is really only taking our religious teachers at their word, that God is here, as constant and as active in the commonest substance we know as in the highest heaven. Science finds the beginning of something like conscious intelligence in the first unicellular life, the first pro-

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tozoön. When two or more cells unite to form a metazoön, it finds a higher and more complex form of intelligence. In the brain of man it finds a confraternity of millions of simple cells, each with a life and intelligence of its own, but when united and coöperating, the intelligence of all *pooled*, as it were, we have the mind and personality of man as the result. This fact leaves no room for the notion that the mind or soul is an entity apart from the organ which it uses. It seems, on the contrary, in some mysterious way to be the result of the multicellular life of the nervous system. Thus we do not banish the mystery of the soul, we only bring it nearer home. We disprove a fable, and are then confounded by the fact that lurks under it. And this proves true in all attempts at ultimate explanations of the phenomena of this world.

It seems as if we saw the hint of prophecy of the vegetable in the mineral — in this growth of crystals, in these arborescent forms of the frost on the pane or on the flagging-stones. One may see most wonderful tree and fern forms upon the pavement, with clean open spaces between them, as much so as in a wood, an endless variety of them. A French chemist has lately produced by inorganic compounds the growth of something like a plant with roots, stem, branches, leaves, buds — a mineral plant, as if the type of the plant already existed in the soil. Yes, the inorganic is dreaming of the

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organic. And the plant in its cell structure, in its circulation, in its intelligence, or in its ingenious devices to get on in the world is dreaming of the animal, and the animal is dreaming of the spiritual, and the spirituality of man touches the spirituality of the cosmos, and thus the circle is complete.

VII

So far as science can find out, *sentience* is a property of matter which is evolved under certain conditions, and though science itself has not yet been able to reproduce these conditions, it still believes in the possibility. If life was not potential in the inorganic world, how is it possible to account for it? It is not a graft, it is more like a begetting. Nature does not work by prefixes and suffixes, but by unfolding and ever unfolding, or developing out of latent innate powers and possibilities; — an inward necessity always working, but never an external maker. It is no help to fancy that life may have been brought to the earth by a falling meteorite from some other sphere. How did life originate upon that other sphere? It must have started here as surely as fire started here. We feign that Prometheus stole the first fire from heaven, but it sleeps here all about us, and can be evoked any time and anywhere. It sleeps in all forms of force. A falling avalanche of rocks turns to flame; the meteor in the air becomes a torch;

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the thunderbolt is a huge spark. So life, no doubt, slept in the inorganic, and was started by the reverse of friction, namely, by brooding.

When the earth becomes lifeless again, as it surely must in time, then the cycle will be repeated, a collision will develop new energy and new worlds, and out of this newness will again come life.

It is highly probable that a million years elapsed between the time when the ancestor of man began to assume the human form and the dawn of history. Try to think of that time and of the struggle of this creature upward; of the pain, the suffering, the low bestial life, the warrings, the defeats, the slow, infinitely slow gains, of his deadly enemies in other animals, of the repeated changes of climate of the northern hemisphere from subtropical to subarctic — the land at one time for thousands of years buried beneath an ice sheet a mile or more thick, followed by a cycle of years of almost tropical warmth even in Greenland — and all of this before man had yet got off of “all fours,” and stood upright and began to make rude tools and rude shelters from the storms. The Tertiary period, early in which the first rude ancestor of man seems to have appeared, is less than one week of the great geologic year of the earth’s history — a week of about five days. These days the geologists have named Eocene, Oligocene, Miocene, Pliocene, and Pleistocene, each one of these days covering, no

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doubt, a million years or more. The ancestor of man probably took on something like the human form on the third, or Miocene, day. The other and earlier fifty or more weeks of the great geologic year gradually saw the development of the simpler forms of life, till we reach the earliest mammals and reptiles in the Permian, about the forty-eighth or forty-ninth week of the great year. The laying down of the coal measures, Huxley thinks, must have taken six millions of years. Well, the Lord allowed himself enough time. Evidently he was in no hurry to see man cutting his fantastic tricks here upon the surface of the planet. A hundred million years, more or less, what of it? Did the globe have to ripen all those cycles upon cycles, like the apple upon the tree? bask in the sidereal currents, work and ferment in the sea of the hypothetical ether before the gross matter could evolve the higher forms of life? Probably every unicellular organism that lived and died in the old seas helped prepare the way for man, contributed something to the fund of vital energy of the globe upon which man was finally to draw.

How life has had to adjust itself to the great cosmic changes! The delays must have been incalculable. The periodic refrigeration of the northern hemisphere, which brought on the ice age several times during each one of the Eocene and Miocene days, must have delayed the development of life as we know it, enormously.

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VIII

From nebula to nebula — these are the hours struck by the clock of eternity: from the dissipation of the solar systems into nebular gas by their falling together to their condensation again into suns and worlds by the action of physical laws — thousands of millions of years in each hour, and the hours infinite in number. This is a hint of eternity. How many times, then, there must have been a world like this evolved in the course of this running down and winding up of the great clock, with beings like these we now behold! how many such worlds and such beings there must now be in the universe, and have always been! Can you think of the number? Not till you can think of infinity. The duration of life upon the globe, to say nothing of man's little span, is hardly a tick of this clock of eternity, and the repetition of the birth and dissipations of systems is well symbolized by the endless striking or ticking of a clock.

Then sooner or later comes the thought, What is it all for? and from the great abysm comes back the echo, "What for?" Is it our human limitations, the discipline of this earthly life, when we have to count the cost and ask what it is for, that makes us put the question to the Infinite? When the cosmic show is over, what is the gain? When our universe is again a blank, who or what will have

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reaped the benefit? Will the moral order which has been so slowly and painfully evolved, and which so many souls have struggled to live up to, still go on? Where? with whom? I seem to see dimly that you cannot bring the Infinite to book, that you cannot ask, "What for?" of the All, — of that which has neither beginning nor end, neither centre nor circumference, neither fulfillment nor design, which knows neither failure nor success, neither loss nor gain, and which is complete in and of itself.

We are tied to the sphere, its laws shape our minds, we cannot get away from it and see it in perspective; away from it there is no direction; at either pole on its surface there is the contradiction of the sky being always overhead. We are tied to the Infinite in the same way. We are part of it, but may not measure it. Our boldest thought comes back like a projectile fired into the heavens — the curve of the infinite sphere holds us. I know I am trying to say the unsayable. I would fain indicate how human and hopeless is our question, "What for?" when asked of the totality of things. There is no totality of things. To say that there is, does not express it. To say there is not, does not express it. To say that the universe was created, does not express the mystery; to say that it was not created, but always existed, does not express it any nearer. To say that the heavens are overhead is only half the truth; they are underfoot also.

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Down is toward the centre of the earth, but go on through and come out at the surface on the other side, and which way is down then?

The Unspeakable will not be spoken.

In the light of science we must see that life and progress and evolution and the moral order must go on and on somewhere, that the birth of systems and the evolution of planets must and does continue, and always has continued; that if one sun fades, another blazes out; that as there must have been an infinite number (how can there be an infinite number? where is the end of the endless?) of worlds in the past, so there will be an infinite number in the future; that if the moral order and the mathematical order and the intellectual order disappear from one planet, they will appear in due time on another.

All that which in our limited view of nature we call waste and delay — how can such terms apply to the Infinite? Can we ever speak truly of the Infinite in terms of the finite? To be sure, we have no other terms, and can never have. Then let us be silent and — reverent.

XII

AN OUTLOOK UPON LIFE

I

THIS chapter, with its personal and autobiographical note, seems to call for some word of explanation. A few years since, a magazine editor asked me, as he asked others, to tell his readers something of what life meant to me, basing the paper largely upon my own personal experiences. The main part of the following essay was the result. The paper was so well received by a good many readers that, with some additions, I have decided to include it in this collection.

I have had a happy life, and there is not much of it I would change if I could live it over again. I think I was born under happy stars, with a keen sense of wonder, which has never left me, and which only becomes jaded a little now and then, and with no exaggerated notion of my own deserts. I have shared the common lot, and have found it good enough for me. Unlucky is the man who is born with great expectations, and who finds nothing in life quite up to the mark.

One of the best things a man can bring into the world with him is natural humility of spirit. About

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the next best thing he can bring, and they usually go together, is an appreciative spirit — a loving and susceptible heart. If he is going to be a reformer and stir up things, and slay the dragons, he needs other qualities more. But if he is going to get the most out of life in a worthy way, if he is going to enjoy the grand spectacle of the world from first to last, then he needs his life pitched in a low key and well attuned to common universal things. The strained, the loud, the far-fetched, the extravagant, the frenzied — how lucky we are to escape them, and to be born with dispositions that cause us to flee from them!

I would gladly chant a pæan for the world as I find it. What a mighty interesting place to live in! If I had my life to live over again, and had my choice of celestial abodes, I am sure I should take this planet, and I should choose these men and women for my friends and companions. This great rolling sphere with its sky, its stars, its sunrises and sunsets, and with its outlook into infinity — what could be more desirable? What more satisfying? Garlanded by the seasons, embosomed in sidereal influences, thrilling with life, with a heart of fire and a garment of azure seas, and fruitful continents — one might ransack the heavens in vain for a better or a more picturesque abode. As Emerson says, it is “well worth the heart and pith of great men to subdue and enjoy it.”

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O to share the great, sunny, joyous life of the earth! to be as happy as the birds are! as contented as the cattle on the hills! as the leaves of the trees that dance and rustle in the wind! as the waters that murmur and sparkle to the sea! To be able to see that the sin and sorrow and suffering of the world are a necessary part of the natural course of things, a phase of the law of growth and development that runs through the universe, bitter in its personal application, but illuminating when we look upon life as a whole! Without death and decay, how could life go on? Without what we call sin (which is another name for imperfection) and the struggle consequent upon it, how could our development proceed? I know the waste, the delay, the suffering in the history of the race are appalling, but they only repeat the waste, the delay, the conflict through which the earth itself has gone and is still going, and which finally issues in peace and tranquillity. Look at the grass, the flowers, the sweet serenity and repose of the fields — at what a price it has all been bought, of what a warring of the elements, of what overturnings, and pulverizings and shiftings of land and sea, and slow grindings of the mills of the gods of the fore-world it is all the outcome!

The agony of Russia at the present time (1904), the fire and sword, the snapping of social and political ties, the chaos and destruction that seem imminent — what is it but a geologic upheaval, the price that

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must be paid for law and order on a permanent basis? We deplore the waste and the suffering, but these things never can be eliminated from the processes of evolution. As individuals we can mitigate them; as races and nations we have to endure them. Waste, pain, delay—the gods smile at these things; so that the game goes on, that is enough. How many thousand centuries of darkness and horror lie between the man of to-day and the low animal ancestor from which he sprang! Who can picture the sufferings and the defeats! But here we are, and all that terrible past is forgotten, is, as it were, the soil under our feet.

Our fathers were cheered and sustained by a faith in special providences — that there was a Supreme Power that specially interested itself in man and his doings, and that had throughout the course of history turned the adverse currents in his favor. It is certain that all things have worked together for the final good of the race as a whole, otherwise it would have disappeared from the face of the earth. But Providence does things by wholesale. It is like the rain that falls upon the sea and the land equally, upon the just and the unjust, where it is needed and where it is not needed; and the evolution of the life of the globe, including the life of man, has gone on and still goes on, because, in the conflict of forces, the influences that favored life and forwarded it have in the end triumphed.

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Our good fortune is not that there are or may be special providences and dispensations, as our fathers believed, by which we may escape this or that evil, but our good fortune is that we have our part and lot in the total scheme of things, that we share in the slow optimistic tendency of the universe, that we have life and health and wholeness on the same terms as the trees, the flowers, the grass, the animals have, and pay the same price for our well being, in struggle and effort, that they pay. That is our good fortune. There is nothing accidental or exceptional about it. It is not by the favor or disfavor of some god that things go well or ill with us, but it is by the authority of the whole universe, by the consent and coöperation of every force above us and beneath us. The natural forces crush and destroy man when he transgresses them, as they destroy or neutralize one another. He is a part of the system of things, and has a stake in every wind that blows and cloud that sails. It is to his final interest, whether he sees it or not, that water should always do the work of water, and fire do the work of fire, and frost do the work of frost, and gravity do the work of gravity, though they destroy him ("Though he slay me, yet will I trust him"), rather than that they should ever fail. In fact, he has his life and keeps it only because the natural forces and elements are always true to themselves, and are no respecters of persons.

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We should not be here blustering around and sitting in judgment upon the ways of the Eternal, had not the ways of the Eternal been without variableness, or shadow of turning. If we or our fortunes go down prematurely beneath the currents, it is because the currents are vital, and do never and can never cease nor turn aside. The weakest force must give way, and the rotten timber break before the sound. We may fancy that there might be a better universe, but we cannot conceive of a better because our minds are the outcome of things as they are, and all our ideas of value are based upon the lessons we learn in this world.

Nature is as regardless of a planet or a sun as of a bubble upon the river, has one no more at heart than the other. How many suns have gone out? How many planets have perished? If the earth should collide with some heavenly body to-day and all its life be extinguished, would it not be just like spendthrift Nature? She has infinite worlds left, and out of old she makes new. You cannot lose or destroy heat or force, nor add to them, though you seem to do so. Nature wins in every game because she bets on both sides. If her suns or systems fail, it is, after all, her laws that succeed. A burnt-out sun vindicates the constancy of her forces.

As individuals we suffer defeat, injustice, pain, sorrow, premature death; multitudes perish to

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fertilize the soil that is to grow the bread of other multitudes; thousands but make a bridge of their dead bodies over which other thousands are to pass safely to some land of promise. The feeble, the idiotic, the deformed, seem to suffer injustice at the hands of their maker; there is no redress, no court of appeal for them; the verdict of natural law cannot be reversed. When the current of life shrinks in its channel, there are causes for it, and if these causes ceased to operate, the universe would go to pieces; but the individual whose measure, by reason of these causes, is only half full pays the price of the sins or the shortcomings of others; his misfortune but vindicates the law upon which our lives are all strung as beads upon a thread.

In an orchard of apple trees some of the fruit is wormy, some scabbed, some dwarfed, from one cause and another; but Nature approves of the worm, and of the fungus that makes the scab, and of the aphid that makes the dwarf, just as sincerely as she approves of the perfect fruit. She holds the stakes of both sides; she wins, whoever loses. An insect stings a leaf or a stem, and instantly all the forces and fluids that were building the leaf turn to building a home for the young of the insect; the leaf is forgotten, and only the needs of the insect remembered, and we thus have the oak gall and the hickory gall and other like abnormalities. The

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cancer that is slowly eating a man up — it too is the result of a vital process just as much as is the life it is destroying. Contagion, infection, pestilence, illustrate the laws of life. One thing devours or destroys another — the parasite destroys its host, the rust destroys the wheat or the oats, the vermin destroy the poultry, and so forth; still the game of life goes on, and the best wins, if not to-day, then to-morrow, or in ten thousand years. In the meantime, struggle, pain, defeat, death, come in; we suffer, we sorrow, we appeal to the gods. But the gods smile and keep aloof, and the world goes blundering on because there are no other conditions of progress. Evil follows good as its shadow; it is inseparable from the constitution of things. It shades the picture, it affords the contrast, it gives the impetus. The good, the better, the best — these are defined to us, and made to entice us by their opposites. We never fully attain them because our standards rise as we rise; what satisfied us yesterday will not satisfy us to-day. Peace, satisfaction, true repose, come only through effort, and then not for long. I love to recall Whitman's words, and to think how true they are both for nations and for individuals: —

“Now understand me well —

It is provided in the essence of things, that from any fruition of success, no matter what, shall come forth something to make a greater struggle necessary.”

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II

Life means such different things to different men and to different generations of men; its values shift from age to age and from country to country. Think what it meant to our Puritan forefathers, the early settlers of New England — freedom of religious opinion, and to worship God in their own way. This was the paramount interest and value of life. To secure this, they were ready to make any sacrifice — friends, home, property, country — and to brave hardship and dangers to the end of their lives. In those days the religious idea pressed heavily upon the minds of men, and the main concern of life related to the other world. We in our time can hardly realize the absolute tyranny of religious prepossessions that the minds of our fathers were under, and that the minds of men were under through all the Middle Ages.

Huxley in his old age said: "It is a great many years since at the outset of my career I had to think seriously what life had to offer that was worth having. I came to the conclusion that the chief good for me was freedom to learn, think, and say what I pleased, when I pleased." This was the old Puritan spirit cropping out again, in quite a different field, and concerned with the truth as it is related to this world, quite irrespective of its possible bearing upon the next.

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The value of life to Huxley lay in the opportunity to give free play to that truth-loving mind of his, no matter where the quest led him. If it led him into battle, as it was bound to do, so much the better. He was "ever a fighter." The love of Truth was his paramount passion, but he loved her all the more if he saw her life jeopardized and he could make a gallant charge for her rescue.

To have a mind eager to know the great truths and broad enough to take them in, and not get lost in the maze of apparent contradictions, is undoubtedly the highest good. This, I take it, is what our fathers meant in their way by saying the chief end of man was to serve God and glorify him forever. This formula is not suited to the temper of the modern scientific mind because of the theological savor that clings to it. Theological values have shrunk enormously in our time; but let the modern mind express the idea in its own terms, and it fully agrees. To love the Truth and possess it forever is the supreme good.

Of course Pilate's question of old comes up, What is truth? since one man's truth may be another man's falsehood. But not in the scientific realm, in the realm of verifiable objective truth. What is one man's truth here must be all men's truth. What is one man's truth in the business affairs of life — in trade, in banking, in mechanics, in agriculture, in law — must be all men's truth. It would seem as

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if what is one man's truth in so vital a matter as religion ought to be all men's truth. But it is not. Religion is such an intensely personal and subjective matter that no two men stand at just the same angle with reference to any one proposition, at least to the evidence of the truth of that proposition. The question of the soul's immortality seems such a vital question to some, while others are quite indifferent to it. One man says, I must have proof. I cannot rest in the idea that death ends all. Another says, What matters it? I am not sure I want endless existence. Ingersoll felt this way. Then if death does end all, we shall not lie in our graves lamenting our fate. If it does not, so much the better.

But is any form of religious belief such a vital matter after all? What noble and beautiful lives have been lived by people of just opposite religious creeds. A man's creed, in our day at least, seems to affect his life little more than the clothes he wears. The church has lost its power, its promises have lost their lure, its threats have lost their terror. It is a question why church attendance has so fallen off. In earlier times people attended church from a sense of duty; now the masses go only when there is a promise of pleasure, and that is less and less often.

Errors of religious belief are not serious. If they were, chaos would have come long ago. Each age repudiates or modifies the creed of the preceding,

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trims it or renews it as a man trims his orchard, lopping off the dead branches, or grafting new ones on, or resetting it entirely. All denominations are grafting on more liberal and more charitable views. The stock of religious ideas is undoubtedly improving — less personal, perhaps, but more broadly intellectual — generalizations from more universal facts.

In morality, what is one man's truth ought to be all men's truth, because morality is a matter of conduct toward our fellows. We may fail to keep our promises to our gods and nothing comes of it, but if we forget our promissory notes, something does come of it, and, as like as not, that something takes the form of the sheriff.

The scientific mind, like Huxley's, looks with amazement upon the credulity of the theological mind, upon its low standard of evidence.

There are currents and currents in life. A river is one kind of current, the Gulf Stream is another. The currents in the affairs of men are more like the latter — obscure in their origin, vague and shifting in their boundaries, and mysterious in their endings, and the result of large cosmic forces. There are movements in the history of men's minds that are local and temporary like that, say, of the Crusaders, or of Witchcraft, and there are others that are like ocean currents, a trend of the universal mind. The rise and growth of rationalism seems of this kind,

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the scientific spirit, the desire to prove all things, and to hold fast to that which is good. It is the conditions of proof that have become strenuous and exacting. The standard of the good has not gone up so much as the standard of evidence. We prove a thing now not by an appeal to a text of some book, or to any ecclesiastical court, but by an appeal to reason. An appeal to conscience is not conclusive, because conscience is more or less the creature of the hour, or of custom, or of training, but reason emancipates us from all false or secondary considerations, and enables us to see the thing as it is, in and of itself.

III

I have drifted into deeper waters than I intended to when I set out. I meant to have kept nearer the shore. I have had, I say, a happy life. When I was a young man (twenty-five), I wrote a little poem called "Waiting," which has had quite a history, and the burden of which is, "My own shall come to me." What my constitution demands, the friends, the helps, the fulfillments, the opportunities, I shall find somewhere, some time. It was a statement of the old doctrine of the elective affinities. Those who are born to strife and contention find strife and contention ready at their hand; those who are born for gentleness and love find gentleness and love drawn to them. The naturally suspicious and distrustful find the world in conspiracy against

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them; the unkind, the hard-hearted, see themselves in their fellows about them. The tone in which we speak to the world, the world speaks to us. Give your best and you will get the best in return. Give in heaping measure and in heaping measure it shall be returned. We all get our due sooner or later, in one form or another. "Be not weary in well doing;" the reward will surely come, if not in worldly goods, then in inward satisfaction, grace of spirit, peace of mind.

All the best things of my life have come to me unsought, but I hope not unearned. That would contradict the principle of equity I have been illustrating. A man does not, in the long run, get wages he has not earned. What I mean is that most of the good things of my life — friends, travel, opportunity — have been unexpected. I do not feel that fortune has driven sharp bargains with me. I am not a disappointed man. Blessed is he who expects little, but works as if he expected much. Sufficient unto the day is the *good* thereof. I have invested myself in the present moment, in the things near at hand, in the things that all may have on equal terms. If one sets one's heart on the exceptional, the far-off — on riches, on fame, on power — the chances are he will be disappointed; he will waste his time seeking a short cut to these things. There is no short cut. For anything worth having one must pay the price, and the price is always work,

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patience, love, self-sacrifice — no paper currency, no promises to pay, but the gold of real service.

I am not decrying ambition, the aiming high, only there is no use aiming unless you are loaded, and it is the loading, and the kind of material to be used, that one is first to be solicitous about.

“Serene I fold my hands and wait;” but if I have waited one day, I have hustled the next. If I have had faith that my own would come to me, I have tried to make sure that it was my own, and not that of another. Waiting with me has been mainly a cheerful acquiescence in the order of the universe as I found it — a faith in the essential veracity of things. I have waited for the sun to rise and for the seasons to come; I have waited for a chance to put in my oar. Which way do the currents of my being set? What do I love that is worthy and of good report? I will extend myself in this direction; I will annex this territory. I will not wait to see if this or that pays, if this or that notion draws the multitude. I will wait only till I can see my way clearly. In the meantime I will be clearing my eyes and training them to know the real values of life when they see them.

Waiting for some one else to do your work, for what you have not earned to come to you, is to murder time. Waiting for something to turn up is equally poor policy, unless you have already set the currents going that will cause a particular some-

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thing to turn up. The farmer waits for his harvest after he has sown the seed. The sailor waits for a breeze after he has spread his sail. Much of life is taken up in waiting — fruitful waiting.

I never have sought wealth, I have been too much absorbed in enjoying the world about me. I had no talent for business anyhow — for the cutthroat competition that modern business for the most part is — and probably could not have attained wealth had I desired it. I dare not aver that I had really rather be cheated than to cheat, but I am quite sure I could never knowingly overreach a man, and what chance of success could such a tenderfoot have in the conscienceless struggle for money that goes on in the business world? I am a fairly successful farmer and fruit-grower. I love the soil, I love to see the crops grow and mature, but the marketing of them, the turning of them into money, grinds my soul because of the sense of strife and competition that pervades the air of the market-place. If one could afford to give one's fruit away, after he had grown it to perfection, to people who would be sure to appreciate it, that would be worth while, and would leave no wounds. But that is what I have in a sense done with my intellectual products. I have not written one book for money (yes, one, and that was a failure); I have written them for love, and the modest sum they have brought me has left no sting.

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I look upon this craze for wealth that possesses nearly all classes in our time as one of the most lamentable spectacles the world has ever seen. The old prayer, "Give me neither poverty nor riches," is the only sane one. The grand mistake we make is in supposing that because a little money is a good thing, unlimited means is the sum of all good, or that our happiness will keep pace with the increase of our possessions. But such is not the case, because the number of things we can really make our own is limited. We cannot drink the ocean because we ever so thirsty. A cup of water from the spring is all we need. A friend of mine once said that if he outlived his wife, he should put upon her tombstone, "Died of Things" — killed by the multitude of her possessions. The number of people who are thus killed is no doubt very great. When Thoreau found that the specimens and curiosities that had accumulated upon his mantel-piece needed dusting, he pitched them out of the window.

The massing of a great fortune is a perilous enterprise. The giving away of a great fortune is equally a perilous enterprise, not to the man who gives it — it ought to be salutary to him — but to his beneficiaries.

Very many of the great fortunes of our time have been accumulated by a process like that of turning all the streams into your private reservoir: they have caused a great many people somewhere to be short

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of water, and have taken away the power of many busy, peaceful wheels. The ideal condition is an even distribution of wealth. When you try to give away your monstrous fortune, to open your dam, then danger begins, because you cannot return the waters to their natural channels. You must make new channels, and you may do more harm than good. It never can go now where it would have gone. The wealth is in a measure redistributed, without enriching those from whom it originally came. Few millionaires could face the questions: Have you rendered a service to your fellows in proportion to your wealth? Have you earned your fortune, or have you grabbed it? Is it an addition to the wealth of the world, or a subtraction from the wealth which others have earned? The wealth that comes to a man through his efforts in furthering the work of the world and promoting the good of all is the only worthy wealth.

Beyond the point of a moderate competency, wealth is a burden. A man may possess a competency; great wealth possesses him. He is the victim. It fills him with unrest; it destroys or perverts his natural relations to his fellows; it corrupts his simplicity; it thrusts the false values of life before him; it gives him power which it is dangerous to exercise; it leads to self-indulgence; it hardens the heart; it fosters a false pride. To give it away is perilous; to keep it is to invite care and vexation of

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spirit. For a rich man to lead the simple life is about as hard as for a camel to go through the needle's eye. How many things stand between him and the simple open air of our common humanity! Marcus Aurelius thought a man might be happy even in a palace; but it takes a Marcus Aurelius — a man whose simplicity of character is incorruptible — to be so. Yet I have no disposition to rail at wealth as such, though the penalties and dangers that attend it are very obvious. I never expect to see it go out of fashion. Its unequal distribution in all times, no doubt, results from natural causes.

Sooner or later things find their proper level, and the proper level of some things is on top. In the jostle and strife of this world the strong men, the master minds, are bound to be on top. This is inevitable; the very laws of matter are on their side.

Not socialism, or any other "ism," can permanently equalize the fortunes of men. The strong will dominate, the weak must succumb. "For whosoever hath, to him shall be given, and he shall have more abundance: but whosoever hath not, from him shall be taken away even that he hath." Power draws power; inefficiency loses even that which it hath. To abolish poverty, to abolish wealth, we must first abolish the natural inequality among mankind. It is as if some men had longer arms than others and could reach the fruit on the tree of opportunity beyond the grasp of their com-

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petitors. Shall we cut off their arms? No, we can only shame them out of making hogs of themselves and of laying up greater stores than they can possibly use. In our day and country, the golden fruit on the tree has been so abundant that the long-armed men have degenerated into wealth-maniacs, and have resorted to all manner of unfair means; they have trampled down the shorter-armed men, and gained an advantage on their prostrate bodies. That is where the injustice comes in. Some of our monstrous trusts and combines, for instance, have killed competition by foul and underhanded means; they have crowded or thrust their competitors entirely away from the tree, or else have mounted up on their shoulders. They have resorted to the methods of the robber and assassin.

I am bound to praise the simple life, because I have lived it and found it good. When I depart from it, evil results follow. I love a small house, plain clothes, simple living. Many persons know the luxury of a skin bath — a plunge in the pool or the wave unhampered by clothing. That is the simple life — direct and immediate contact with things, life with the false wrappings torn away — the fine house, the fine equipage, the expensive habits, all cut off. How free one feels, how good the elements taste, how close one gets to them, how they fit one's body and one's soul! To see the fire that

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warms you, or better yet, to cut the wood that feeds the fire that warms you; to see the spring where the water bubbles up that slakes your thirst, and to dip your pail into it; to see the beams that are the stay of your four walls, and the timbers that uphold the roof that shelters you; to be in direct and personal contact with the sources of your material life; to want no extras, no shields; to find the universal elements enough; to find the air and the water exhilarating; to be refreshed by a morning walk or an evening saunter; to find a quest of wild berries more satisfying than a gift of tropic fruit; to be thrilled by the stars at night; to be elated over a bird's nest, or over a wild flower in spring — these are some of the rewards of the simple life.

XIII

"ALL'S RIGHT WITH THE WORLD"

I

WHETHER or not we can accept Browning's morning line, "All's right with the world," depends upon our point of view. To the intellect, the disinterested faculties, undoubtedly, all's right with the world. To the seeing mind nature presents a series, an infinite series, of logical sequences; cause and effect are inseparably joined, and things could in no wise be other than what they are. The forces that destroy us are only going their appointed ways, and if they turned out or made an exception on our account, the very foundations of the universe would be impeached.

The creation is good, and man's explanation and vindication of it have given rise to what we call science. One recalls Whitman's lines:—

"I lie abstracted and hear beautiful tales of things and the
reasons of things,
They are so beautiful I nudge myself to listen."

To our æsthetic faculties, all's right with the world. What beauty, what grandeur, what perfection! the sum of all we know or can know of

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these qualities. Sin, decay, ruin, death — all add to the picturesqueness of the world.

But to our moral sentiments, our sense of goodness, mercy, justice, benevolence, humility, self-denial — all those tender and restraining feelings that are called into action through our relations to our fellows, all is not right with the world. All, or nearly all, is wrong with the world. So much so that our fathers, to account for it, had to suppose some dire catastrophe had befallen creation and frustrated the original plan of the Creator. Hence the myth of Adam and Eve in the Garden, and the forbidden fruit that

“Brought death into the world and all our woe.”

The world is full of pain, suffering, cruelty, sin, defeat, injustice, hope deferred, calamities of fire, flood, storm, pestilence, wars, famine — young lives cut off in their bloom, old lives ending in sorrow and decrepitude, iniquity on the throne, virtue in the dust. How is love thwarted, how is pity shocked, how is our sense of mercy and of justice outraged, when we look out upon the world, past or present!

Tract after tract of history is knee-deep with blood, and mostly innocent blood. The cruelty of rulers, the blindness and infatuation of the people, the superstition of priests — waste, failures, anguish, treachery, greed everywhere — how the moral nature revolts at the spectacle of it all!

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Cardinal Newman drew back from the spectacle with the deepest distress. Not seeing God in the world, he said, was like looking into a mirror and not seeing his own face there. He could account for the fact only by inferring that the human race was implicated in some terrible aboriginal calamity. Had the cardinal looked creation over, he would have seen evidence of the same merciless strife, the same cruel struggle, and mystery, and failure everywhere.

This is the verdict of the moral sense, the cry of the wounded heart. It is not the vision of the intellect, it is the plaint of the benevolent emotions. In the face of it all the serene reason still sings, All's well with the world, all's well with man; still he mounts and mounts; "rise after rise bow the phantoms behind" him; sin and suffering are a condition of growth and development; the great laws are impersonal; the God of the intellect is without variableness or shadow of turning, he sends his rain upon the just and the unjust alike, and though he slay me, yet will I trust him; though a cry of pain and anguish ever goes up from the earth to a deaf heaven, the reason sees that life and the joy of life can be had on no other terms.

Newman found God only when he looked into his own conscience, into that artificial personality, as Huxley called it, which has been built up in each of us through ages of contact with our fellows

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There he found the benevolence, the love, the sense of justice, which he failed to find in the world without. It is not a mere fling or witty retort that man creates God in his own image; it is profoundly true. And then he torments himself that he does not see this image reflected in nature. More and more, as his evolution goes on, he loves mercy, justice, goodness, and more and more he endows his gods with these attributes. In the long-past time, when those sentiments were far less developed in man, we find his gods much more cruel and wicked.

All moral and ethical sentiments and aspirations are purely personal, and relate to man in society. They are the fruit of the social aggregate. It may be said with a measure of truth that while man's intellect is from God, his moral nature is the work of his own hands. His reason is reflected in the course of nature; it is in unison with the cosmic process; it looks upon the world and says it is good; it is consistent and fulfills its own end. But his moral nature is not reflected in the objective world; there is hardly a trace of it there; there is only law which knows no mercy, or tenderness, or forgiveness, or self-sacrifice, and which is oblivious to pain and suffering. Hence the God which our moral nature demands is not found in the world; to the cosmic process he is a stranger; it rules him out as it rules out all our human weaknesses. Fly to the uttermost parts of the earth, and you will not find him there,

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or soar to the heavens or dive to the depths, and you will not find him there. Infinite and eternal power you find, but not the God of love and mercy that the moral nature craves. Only in the human heart do you find this God. Hence our fathers looked upon man as something entirely apart from nature; he was not the result of the cosmic process, but a special creation, endowed with special powers, and given an immortal soul, which was denied to all other creatures.

It is only by regarding man as a part of nature, as the outcome of the same vital forces underfoot and overhead that the plants and the animals are, that we can find God in the world.

When the intellect from its height of observation surveys man and the world, it sees that he is necessarily a part of nature, and that all he has done and thought and suffered, all his arts and religions and literatures, all his dreams and visions and aspirations, came out of the earth, were evolved through the working of natural or cosmic laws, because the reasoning mind cannot admit of the arbitrary introduction of any force or influence from without. The chain of cause and effect is never broken, and all the noble and godlike traits of man, all his love and heroism and self-denial, as well as all his baser animal traits—his hates, his revenges, his cruelty, his lusts, his meannesses of one kind or another—are not from some extraneous source, are not for-

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tuitous and unrelated, but have their root in the constitution of things. There is nothing on or in the earth that is not of the earth; it is all latent or patent in the cosmic process.

II

Strange how men have speculated about the origin of evil, and built themselves cages in which to bruise their own wings. Evil has been regarded as something as positive as light, or heat, or any tangible object. Our moral and religious nature has so regarded it, but the reason sees that evil is only the shadow of good, and is as inevitable as good is inevitable. Life has its positive and its negative sides. Its positive side is health and growth and enjoyment, its negative side is disease and decay and suffering. All that favors the former is good, all that leads to the latter is bad, relatively bad. Disease is only another form of life. The germs that are pulling us down and destroying us in typhoid fever or cholera are healthy and thriving if we are not. What is good for them is bad for us. Life preys upon life everywhere, and the devoured is the victim of evil. We live and move and have our being submerged in an ocean of germs, myriads of them for us and myriads of them against us on occasion; one kind building up, another kind pulling down, and, as it were, redistributing the type. Life as we know it could not go on without both

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kinds. Without the germs of fermentation, for instance, what would happen to the world? Without the germs that break down animal and vegetable tissue and redistribute the elements of which they are composed — the germs of death — how long could life go on?

A fever tortures and burns my flesh because the body fights against the germs that would destroy it. It is one form of life struggling with another form. A festering pool in the fields or woods conceals chemical processes that all favor life.

Life is the result of a certain balance between what we call good and evil forces. Destroy that balance, that harmonious adjustment, and death or disease follows. We imperil it when we eat too much, or drink too much, or work too hard, or sleep too little, or exclude the air and sunlight from our houses. A pestilence is just as much an evidence of the health and soundness of nature as is immunity from it, only it is the health of forces that for reasons antagonize our health. We have let the enemy encamp and intrench in our midst while we slumbered. If we had life on easier terms than eternal vigilance, what would it be worth? If we want to escape blow-flies and mosquitoes and the contagion of this or that, let us go to the Arctic or Antarctic regions, where death reigns perpetual.

Struggle is the condition of evolution, and evolution is the road all life has traveled. Moral evil

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pertains only to man, and is incident to his growth and development. To bear false witness against one's neighbor, or to steal, or to be cruel or covetous, are moral evils which we become conscious of only when we have reached a higher moral plane. The animal is not involved in such evils. Violence and fraud and injustice attest the existence of higher qualities. They are shadows and not real entities, the shortcomings of the unripe animal man. A foul day is just as much a legitimate part of our weather system as a fair day; and is it in itself any more evil?

What I mean to say is that the whole category of moral evils, from petty slander to gigantic stealing, from political corruption to social debauchery, are only eddies or back currents that attest the onward flow of moral progress. A parasite is an evil, but it could not exist without a host to prey upon.

Moral evil, like physical evil, is bestowed by the same hand that bestows the moral good; it is the fruit of the same tree — the wormy and scabby fruit — and while every effort is to be made to remedy it, we are not to regard it as something foreign to us, something the origin of which is involved in mystery, a subject for metaphysical or theological hair-splitting, and adequate to account for the strained relations, as our fathers viewed it, between God and man. Development implies imperfection; as long as our course is upward, we have

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not yet reached the top of the hill. Our standards rise as we rise, and the ideal always does and always will outrun the real. We may produce a perfect apple or a perfect peach, or plum, or pear, but not a perfect man, because to man are opened infinite possibilities. Perfect in honesty, in sobriety, in truthfulness, but not perfect in love, or sympathy, in self-denial, in veneration, or in wisdom. That good and evil are not such strangers is seen in the fact that present evil may turn out a future good, and *vice versa*. All the world looks upon poverty as an evil, yet of what men has it been the making! Reverses in business have often put a man upon a road that led to a higher success than was possible under the old conditions, a success which only verifies the soundness of the principles the disregarding of which led to the past failure. If gravity did not pull your faulty structure down, it would not enable your sound structure to stand up. If the rain did not come through your rotten roof, it would not percolate to the roots of the grass in the ground. Indeed, to abolish the possibility of evil from the universe would be to abolish the possibility of good. If vice and crime did not arise under certain conditions in society, all social progress would be barred. Out of the desire to better our condition comes the greed of wealth and the hoggishness of the millionaire. Out of sex love comes lust and fornication; out of the instinct of self-preservation comes base

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selfishness; the feeling of self-respect pushed a little too far becomes pride and vainglory; faith degenerates into credulity, worship into idolatry, deference into fawning, firmness into hardness of heart, self-reliance into arrogance. The danger that threatens repose is stagnation, that threatens industry is greed, that threatens thrift is avarice, that threatens power is tyranny. Everywhere are things linked together, every virtue has its vice, every good has its ill, every sweet has its bitter, and the bitter is often the best medicine.

What shall we say, then? Shall we be tolerant of evil? Shall we embrace vice as well as virtue? No; but we shall cease to try to persuade ourselves "that the celestial laws need to be worked over and rectified," that there is some ingrained defect in God's universe, and that the divine plan miscarried; that man in this world has got the bad end of a bad bargain. We get sooner or later what we pay for, and we do not get what we do not pay for, and there is no credit system.

"All's right with the world." I know it does not soothe the bruises of the victim of a railroad smash-up to be told that the laws of force could not act differently, nor the disappointment of the farmer when his crops are burned up by the drought to be assured that the weather system is still running all right elsewhere, nor the sick and the suffering to be told that pain too is a guardian angel; and yet it

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is something to know that things look better under the surface, that there is no profound conspiracy of evil against us, that the universe really has the well-being of each of us at heart, and that if we fall short of that well-being, we are not the victims of a malignant spirit, but the sufferers from the operation of a beneficent law.

The universe has our well-being at heart in a general, universal sense, and not in a personal sense. For instance, our lives depend upon the bounty of the rain, and yet the rain does not accommodate itself to the special personal needs of this man or that man, and it may result in a flood that brings death and ruin in its path. Like all other things in nature, it is a general beneficence to which we have to accommodate ourselves. It rains alike upon the just and the unjust, upon the sea and upon the land, upon the sown field and upon the mown hay — a broadcast, wholesale kind of providence.

I confess that from the course of life and the processes of nature one cannot infer the existence of a Being such as our fathers worshiped — a kind of omnipresent man, whose relation to the universe was that of maker and governor.

We get instead the conception of an infinite power, not separable from the universe, but one with it, as the soul is one with the body, which finally expresses itself in man as reason, as love, as awe, as beauty, as aspiration, as righteousness; in

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the brute world as instinct, cunning, ferocity, and other animal traits; in the material world as law, system, development, power. When we think of God in any kind of human relation to the universe, or as a being apart from it, as parent, judge, sovereign, guide, we at once stumble upon this problem of evil, and invent schemes to justify God's ways to man, to excuse or gloss over the cruelty, the suffering, the injustice, we see in the world; we invent the devil, the garden of Eden, the myth of the fall of man, sin, the atonement, the judgment day. These things flow naturally from our anthropomorphic conception of God. They help reconcile the irreconcilable; they bridge over the chasm. But to the naturalistic conception, as distinguished from the theological, these things are childish dreams, to be put from us as we put away other childish things. Sin has no more reality than the negative gravity that Frank Stockton imagined, redemption no more reality than the rebellion in heaven that Milton invented, and heaven and hell no more existence than any other fabled abode of the ancient world.

To science, every day is a judgment day, eternity is now and here, heaven lies all about us, all laws are celestial laws. God is literally in everything we see and hear and feel, in every flower that blows, and not a sparrow falls to the ground without his cognizance. Your days are appointed, and all the hairs of your head are numbered, because nothing

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goes by chance in this universe. Not a snowflake falls but its form and its course are determined by forces as old as the universe; pitch a stone from your hand and the elder gods know exactly where it shall alight. Is not this good predestinarianism? Yes, but not as Jonathan Edwards saw it; it is as science sees it. It is good everlastingism — the ways of a Power without variableness or shadow of turning, which Edwards anthropomorphized into a cruel, despotic, almighty man. We are predestined to heaven or hell by the dispositions we inherit from our fathers, by the environment which society makes for us, by the age and country in which we live, and by the strength and weakness of our own characters, which again are the result of forces as old as the race, and as constant and impersonal in their activity as gravitation.

The rising vapor proves gravitation as fully as the falling rain. The wildest, freest thing on wings goes only its appointed way. With the course of the swallow hawking for insects in the air, or with the course of the insects themselves soaring in the sunshine, the hand of chance plays no part any more than it does with the sailboat obeying wind and current on yonder bay, which again is a good symbol of a man's course throughout this world, impelled by impulses inherited from his fathers, and awakened by the circumstances of his life.

We speak of the chance meeting of this man and

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that woman which resulted in a union for life, and, so far as their conscious wills were concerned, the meeting was a matter of chance; but if we could see all the forces that have been at work to bring them together, we should discover that there was no more chance about it than about the conjunction of two planets in the evening sky.

Indeed, our lives are evidently the result of such a play and interplay of forces from far and from near, from the past and from the present, from the earth and from the heavens, forces so subtle and constant and so beyond the reach of our analysis, that one is half converted to the claims of astrology, and inclined to believe that the fate of each of us was written in the heavens before the foundations of the world.

III

Don't you suppose that if the trees in the forest, the grass in the field, the fruit in the orchard, could for a moment be conscious and speak, they would each and all say, There is evil here also, there is crime, there is sin, there is struggle, defeat, and death also? One plant could complain that there is another plant stealing from it, or trespassing upon its territory and robbing it; another is being crowded to the wall, another being dwarfed by its bigger and more sturdy neighbor. Cut down a tree in the forest, and in the spring a half dozen or more shoots start

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from the stump to replace the parent trunk. They all grow vigorously the first season; the whole push of the complex root system of the stump is behind them. They grow vigorously the second season, and the third, and maybe for several years more. But the competition becomes sharper and sharper; some of the shoots, from causes hard to penetrate, outstrip their fellows, they get the lead, they get more light, more foliage, and this enables them to take up more nourishment from the soil. The others lag, then stop, then die. Then the struggle among the three or four or five thrifty shoots goes on for a few years longer, till some of them are distanced, and finally die when they are the size of one's leg. Then two or three remain to take the place of the parent trunk. We witness here the same struggle that we witness in the animal world. It is all a question of the means of subsistence; the soil can nourish only just so much life, and the fittest or luckiest gets this nourishment, just the same as when you throw a bone to a pack of hungry dogs.

Sometimes the grain will "run out" the weeds, and sometimes the weeds will run out the grain, or the grass. The cereals that depend upon man, and that he depends upon, cannot of course hold their own with the wild denizens of the soil. Much care and culture has made them weak; they have grown dependent; they must be fed and cosseted and protected, the battle against the foes of life

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must be fought for them. All these cultivated plants are handicapped by a burden the wild things do not bear; the wild things are mainly bent only upon self-propagation: to this end their seeds are small and numerous; but the cultivated grains and vegetables bear a burden of food for man, aside from the germ necessary to their propagation. Wild rice is a lean, savage, hirsute product compared with the cultivated varieties; but the potato and the onion and the pippin — what a burden of starch and of other elements each bears, in contrast with the wild species!

Evil comes to the fruit tree in the orchard in the shape of frost that nips the fruit buds, or of worms that eat its foliage, or in the shape of birds that cut out the heart of the blossom, or in the shape of insects that lay their eggs in the baby fruit, or in the shape of fungus growths that fasten upon it and dwarf it or mar it. Evil threatens and sooner or later comes to everything that lives. Evil in this sense is a necessary part of the living universe; there is no escape from it. A world of competition, of diverse and opposed interests, is a world of struggle, of defeat, of death.

After the ice has been all nicely formed in the river, a miracle of crystallic beauty and perfection, the winds or the tides break it up and bring chaos to it. But the cold continues, the ice-packs freeze together, or new ice forms, the ruin of the first

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venture of the frost is a stepping-stone in the second; the river is again covered and may be again broken up, but by and by, under a still lower temperature, the thing is done and the river permanently frozen over. Then the struggle is between the frost and the sun till, in the spring, the latter wins.

IV

At least one thing is certain as the result of man's sojourn on this planet: he is becoming more and more at home on it, more and more on good terms with the nature around him. His childish fear and dread of it is largely gone. He now makes playfellows of things which once filled him with terror; he makes servants of forces that he once thought stood ready to devour him; he is in partnership with the sun and moon and all the hosts of heaven. He no longer peoples the air and the earth with evil spirits. The darkness of the night, or of caverns and forests, no longer conceals malignant powers or influences that are lying in wait to devour him. Even Milton speaks of

"this drear wood,
The nodding horror of whose shady brows
Threats the forlorn and wandering passenger."

To us the wood is filled with beauty and interest; the mountain is a challenge to climb to a vaster and higher outlook, and the abysmal seas hold records we would fain recover and peruse. Evil omens and

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prognostications have disappeared. Dread of Nature has been followed by curiosity about Nature, and curiosity has been followed by love. Men now love Nature as I fancy they have never loved her before. I fancy also that we have come to realize as never before the truth of the Creator's verdict upon his work: "And behold it was good."

To what do we owe this change? To the growth of the human reason led and fostered by science. Science has showed man that he is not an alien in the universe, that he is not an interloper, that he is not an exile from another sphere, or arbitrarily put here, but that he is the product of the forces that surround him. Science has banished the arbitrary, the miraculous, the exceptional, from nature, and instead of these things has revealed order, system, and the irrefragable logic of cause and effect. Instead of good and bad spirits contending with one another, it reveals an inevitable beneficence and a steady upward progress. It shows that the universe is made of one stuff, and that no atom can go amiss or lose its way.

When we look at man and his goings and comings at a far enough remove, I think we surely see that he is under laws and influences that he knows not of. In the Orient he shows one set of influences, in the Occident another. In the south he is of one temper, in the north of another. The stamp of his environment, of his climate, is upon him. Born in one age.

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he is seized with the spirit of adventure and plants colonies and kingdoms. Born in another, he rusts out at home. One age is of one complexion, another of another; one is an age of faith, the next an age of skepticism; the enthusiasm of one age is the joke of the next. We are puppets all, and obey unseen masters. The Time-spirit sets its seal upon us. The electric currents or the waves of vibration that cause the steel filings to spring into patterns are like the influences in an age that cause men to form parties and groups of one kind or another, swayed by a common impulse, the origin of which is in the will of none of them.

What, then, becomes of the freedom of the will of which we are all conscious? We do as we like. Yes, but what determines our liking? In this freedom fate is deftly concealed. Our choice is along the lines of forces or inborn tendencies of which we are unconscious. We are free to do as our inherited traits, our temperament, our environment, our training, the influence of the climate over us, and the geography and geology about us and beneath us decide. But these things are vital in us, and therefore we are unconscious of them. Hence our sense of free choice is not obstructed; we still do as we like, only something beyond our wills determines what we shall like.

The intellectual nature of man was developed long before his moral nature. His sense of beauty,

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of art, of ornament, is older than his sense of justice or mercy. Indeed, he was a religious being before he was a moral being. He worshiped and offered sacrifices before he dealt justly and humanely with his fellow.

Unless what we mean by good prevailed over the bad, we should not be here. If some sort of order and peace had not come out of the primal warring of the elements, man could not have appeared. The waters have been gathered together, the continents have been lifted up, the vapors have learned to form clouds, the soil has been formed, and the benediction of the flowers and of the grass is upon the hills. The destructive elemental forces have subsided. In nearly all parts of the earth man can subsist. The benevolence of Providence is seen in this general, inevitable course of nature. Right actions meet with their reward; health and wholeness are possible; deal fairly and squarely with Nature, and you always get the worth of your money. We know the conditions of disease; we know the conditions of health. The ways of the Eternal are appointed, and we may find them out.

Truly to obey the will of God is our salvation, but we must look for this will, not in some book or creed, but in the order of the universe, in the sequence of cause and effect.

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